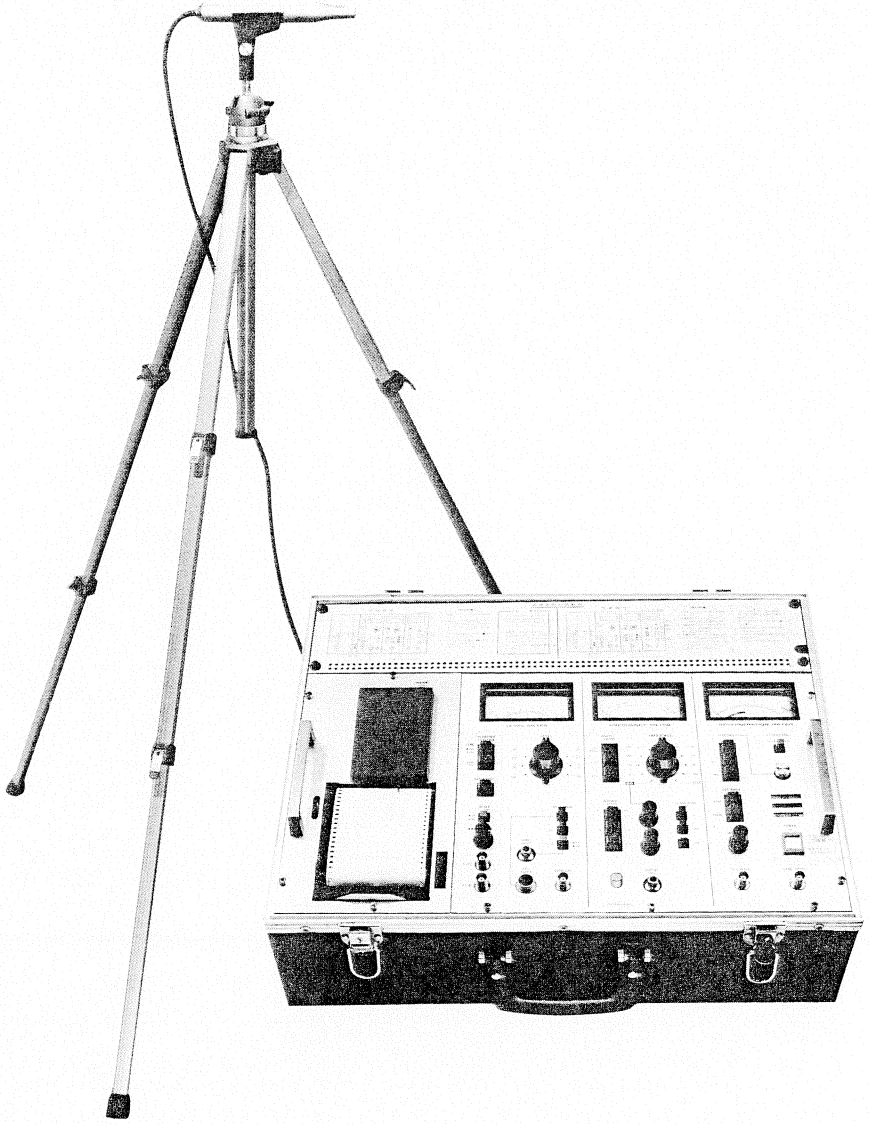
ACOUSTIC MEASURING SYSTEM

SE-3000



FEATURES

* **The acoustic measuring system Model SE-3000 features compact styling, easy operation, and space-saving installation.**
* **This instrument is designed to provide the following functions:**
  1. Automatic sweep warble tone oscillator combined with recorder for recording transmitted frequency response.
  2. Reverberation time of any frequency is indicated on the automatic mean value measuring type reverberation meter using warble tone-brust signal. The reverberation time is also recorded on a graph by the pen recorder. The reverberation meter has a linear scale calibrated in 2 ranges (1 sec F.S/2 sec F.S) for accurate measurements even in an acoustically dead room. Attenuation curve of reverberation is also recorded.
  3. Frequency response can be visually checked by connecting an oscilloscope to the V (DC) terminal and H (⌐¬) terminal.
  4. By connecting a trigger synchro type oscilloscope to the REV. WAVE and SYNC OUTPUT terminals, reverberation time can be measured while observing attenuation curve.
* **This equipment is also capable of measuring various characteristics of audio system:**
  1. Measures and records frequency response, S/N ratio, tone control characteristic, equalizer characteristic, etc.
  2. Measures and records recording and playback characteristics of tape recorder.
  3. Measures and records frequency response of record player cartridge by using a frequency test record. By using the Line Input Filter, the built-in equalizer and 18 Hz cut-off high-pass filter, which perfectly match the characteristics of records, record the frequency response with minimum noise.
* **The recorder is equipped with a newly developed IC pen (thermic type) which has the following features:**
  - No ink is used.
  - Clear recording.
  - Long service life.
  - High reliability.
  - Easy operation.
  - Low running cost.

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SPECIFICATIONS

SIGNAL GENERATOR

Oscillating Frequency: 20 Hz ~ 20 kHz

Frequency:
Spot oscillation (manual) 63, 125, 250, 333, 500, 1k, 2k, 4k, 8k, 16k 333 (Hz)
Continuous adjustment (manual) 20 Hz ~ 20 kHz
Logarithmic automatic sweep 20 Hz ~ 20 kHz

Frequency Accuracy: Within ±(2% + 3 Hz)

Meter Indication Accuracy: Within ±(10% +3 Hz)

Frequency Response Within ±0.2 dB

Output Voltage: 6 Vrms ±10% (at no-load)

Distortion: Less than 2% (20 Hz ~ 20 kHz)

Output Impedance: 600 ohm ±10%

Output Attenuator: 0 dB, 20 dB, 40 dB and variable

Warble Frequency: 5 Hz, 10 Hz, 20 Hz

Warble Width: 1/3 OCT, 1 OCT

Tone-Burst Wave: 0.2 sec ON, 1 sec. OFF

LEVEL INDICATOR

Measurement Range:
Line input: −60 dB ~ +20 dB (0 dB = 1V)
MIC input: 40 dB ~ 120 dB (0 dB = 0.0002μ Bar)

Accuracy:
Line input: ±5% of full scale
MIC input: ±2 dB

Frequency Response:
Line input: ±0.5 dB

Noise Weight (MIC Input): JIS (1502) A curve

Filter (Line Input):
Set to ON when measuring cartridge characteristics.
Reverse characteristics of recording characteristic (B & K) is obtained. Also, 12 dB/OCT H.P.F. (18 Hz cut-off) is energized.

Monitor Output: 1 Vrms ±10% (line input full scale at no-load)

Monitor Output S/N:
Line input: more than 40 dB (full scale)
MIC input: more than 20 dB

Input Impedance:
Line input: 100k ohm,
MIC input: 10k ohm

REVERBERATION INDICATOR

Measurement Range: 0.1 sec ~ 1 sec, 0.1 sec ~ 2 sec, 2 ranges

Frequency Range: 63, 125, 250, 500, 1k, 2k, 4k, 8k, 16k, 9 points

Measurement System: Attenuation time measurement

Indicating System: Meter (mean value of 5 measurements)

Required S/N: Better than 20 dB

Output: REV. WAVE (0 ~ 2.5V DC), SYNC OUT (±15 Vp-p)

RECORDER

Chart Paper: 80 mm × 40 m (80 mm × 300 mm per section)

Paper Feed Speed: 3 mm/sec, 30 mm/sec, within ±2% (at 20 Hz ~ 20 kHz)

Recording Range: 25 dB, 50 dB, 2 ranges

Recording Accuracy: ±0.5 dB (25 dB range), ±1 dB (50 dB range)

Paper Feed Mode:
INT ..... Internal synchronizing start
EXT SYNC ..... Auto start with pilot signal
PAPER FEED ..... Paper feed 30 mm/sec 3 mm/sec (at EXT. SYNC or GRAPH measurement)

Recording System: IC pen (thermic pen)

Output: V (DC) 0 ~ 3.5V DC, H (⎍) 6 Vp-p

SPECIFICATIONS

MICROPHONE

Type:	Electret condenser type (omni-directional)
Frequency Response:	20 Hz ~ 20 kHz, ±3 dB
Sensitivity:	−65 dB ±2 dB

POWER SUPPLY

Power Voltage:	AC 100/117/220/240V
Power Consumption:	Less than 40W
Dimensions:	180(H) × 470(W) × 388(D) mm
Weight:	13.5 kg

ACCESSORIES

Protractor	1
Microphone (with 7 m cord)	1
Microphone stand (one-touch system)	1
BNC-BNC cord (1.5 m)	2
Pin-plug – pin-plug cord (3 m)	1
Pin-plug – clip cord (1.5 m)	1
Chart paper	2 rolls
Fuse (0.5A)	2
(1A)	2
Instruction manual	1

CIRCUIT DESCRIPTION

GENERAL

The SE-3000 is composed of the recorder unit, level indicator unit, signal generator unit, reverberation indicator unit, control unit and power supply unit. The level indicator unit consists of the level meter unit and pen recorder unit, the signal generator unit consists of the oscillator unit and sweep unit, and the reverberation unit consists of the reverberation indicator unit and mode selector unit. The power supply unit is designed to feed +5V to the TTL LS series circuit in the control unit, +6.3V to the lamp circuit, ±10V to the oscillator circuit, ±15V to the OP amplifier, and +12V and ±18V to drive the pen recorder.

The control unit is composed of the TTL LS series and CMOS IC's to control all the circuits. The oscillator unit is a function type oscillator covering oscillating frequencies of 20 Hz to 20 kHz for spot oscillation, auto sweep oscillation and manual sweep oscillation. The sweep unit is used to automatically sweep the oscillating frequencies from 20 Hz to 20 kHz.

The level indicator unit has a circuit to amplify MIC inputs and line inputs, a reverse equalizer for test records and an "A" curve filter (JIS 1502) for measuring noise.

The pen recorder unit generates a logarithmically compressed signal to drive the pen recorder. It is also used to detect the starting time for EXT synchronization.

The reverberation indicator unit is used to indicate a reverberation time, an average of 5 measurements, on the reverberation meter. Mode selector unit consists of a switch to select the mode of functions.

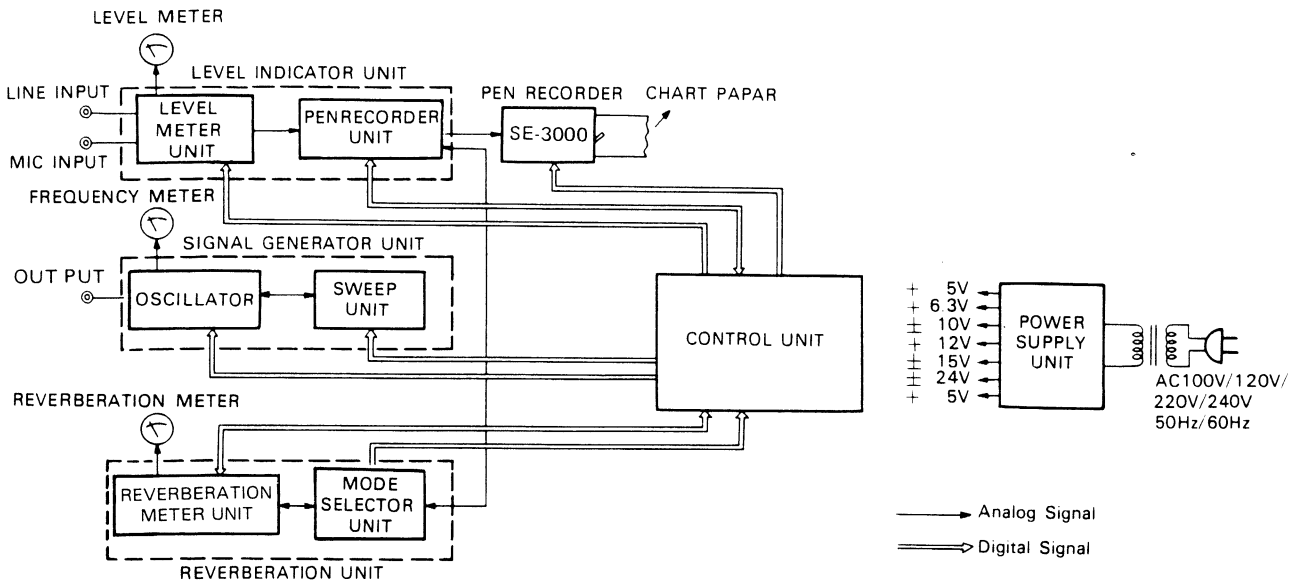


Fig. 1 Block Diagram of SE-3000

SIGNAL GENERATOR UNIT

The signal generator unit is composed of the oscillator unit and sweep unit.

Saw-tooth wave circuit

The saw-tooth wave circuit generates saw-tooth waves of 0 to 6V. At the INT position of the SYNC switch, the saw-tooth wave of +6V is obtained 5 seconds later by the time constant of R405 and C401, and at the EXT position, 50 seconds later by the time constant of R406 and C401, while the reference voltage "E_1" is obtained through R403, R404 and VR402. The relation between the output voltage "E out", time constant CR and time "t" is represented by the following formula:

$$E_{out} = \frac{1}{CR}\int E_1 dt$$

The time constants of 5 and 50 seconds are selected by changing the value of R. When the saw-tooth wave circuit is in auto sweep mode, the analog switch IC406 turns OFF and C401 is charged through R405 and R406. Normally, IC406 is ON and the capacitor C401 is shorted, so the saw-tooth wave circuit is inoperative.

WARBLE circuit

The WARBLE circuit is a triangle wave circuit to generate a warble tone (oscillation). The voltage divided R410 and R411 is charged in C402 through R412, R413 and R414. When this voltage exceeds the voltage determined by R415 and R416 in the comparator IC402, the output voltage of IC402 is reversed in polarity and the capacitor C402 is discharged, thus generating a triangle wave.

CIRCUIT DESCRIPTION

MIX circuit

The MIX circuit is used to mix the sweep signal of 0~6V with the triangle wave for warble tone. The sweep signal voltage is reduced to 0~3V through R417 and R421, while the triangle wave is converted through R419, R420 and R421. A voltage of −3V is fed to R418 to maintain the output voltage of IC403 at 0~3V.

Anti-Log circuit

The signal from the anti-log circuit is fed to the input of the oscillator for logarithmic sweep. The input voltage of the anti-log circuit is 0~3V and the output voltage is 0~10V.

LEVEL SHIFT circuit

A voltage of 0~10V is reduced to 0~4.5V through VR301, R301 and R302 to obtain 10~4.5V at the collector of Q302. So, a voltage of 10~4.5V is fed to the emitter of Q304 and an output voltage of −10V to −4.5V is obtained at the collector. The 20 Hz signal is oscillated at 10V, and a 20 kHz signal at 4.5V.

V-F converter circuit

This circuit is composed of the triangle wave generator circuit and comparator to convert voltage into frequency. It generates a triangle wave when C301 is charged and discharged through the diode by the current "I" developed by the voltage difference across R307 and R308. When the Q314 collector is "H", the voltage of

$$E_H = \frac{1}{C301} \int I_H dt$$

is developed in C301 through the follower circuit consisting of Q309, Q310 and Q311, which is applied to R313. This voltage increases until it reaches +1V.

When the Q314 collector is "H", a voltage of 0.5V determined by VR305, R319 and R318 is applied to the Q313 base. If the Q312 base voltage exceeds 0.5V, the Q314 collector becomes "L" and a voltage of −0.5V determined by R318, R320 and VR306 is applied to the Q313 base, while the voltage of

$$E_L = \frac{1}{C301} \int I_L dt$$

is developed in C301 through R308, which is discharged until the Q312 base voltage exceeds −0.5V. When this voltage exceeds −0.5V, the Q314 collector becomes "H" and C301 is charged. This action is repeated and thus the oscillation is effected.

Sine proximity circuit

This circuit is converted a triangle wave into a sine wave through a sine proximity circuit. A triangle wave of ±1 Vp-p is converted into a sine wave of ±0.18 Vp-p.

AMP circuit

This circuit provides a sine wave output of 6 Vrms with the gain determined by R335 and R338. Q318 is normally ON but turns ON and OFF when a tone burst wave is outputted during measurement of reverberation time.

ATT circuit

This circuit is composed of R344 through R348 to form an attenuator for 0 dB, −20 dB and −40 dB.

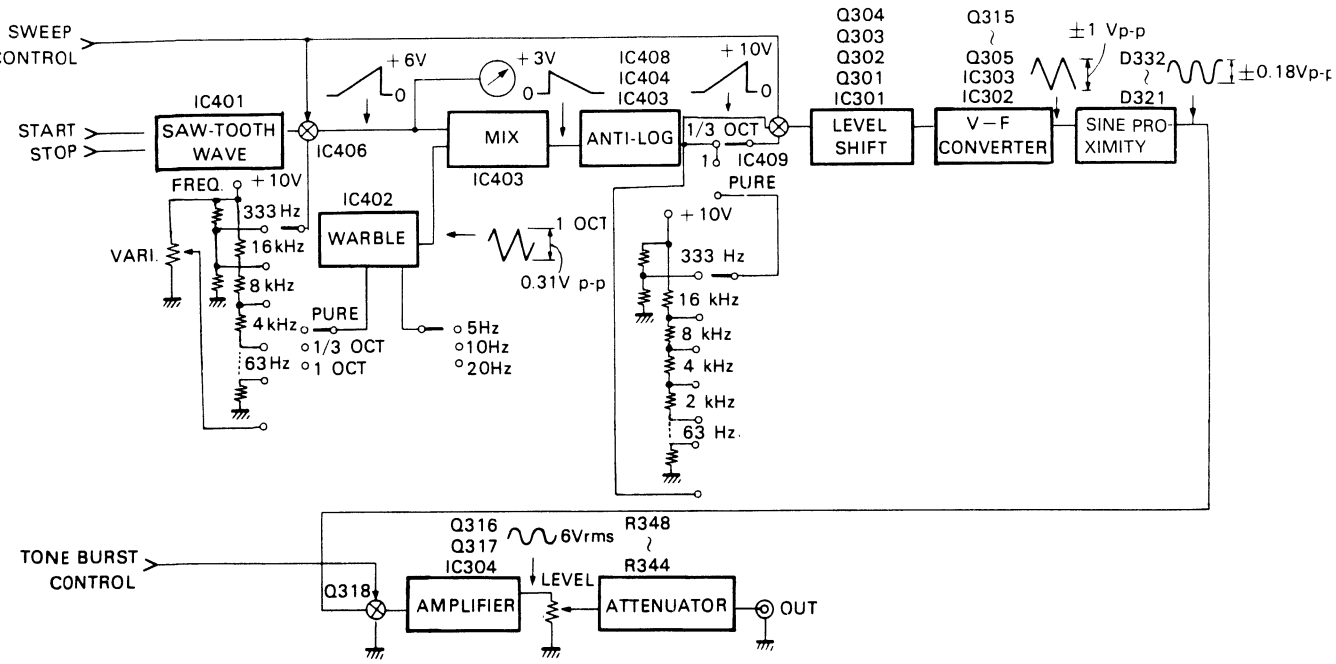


Fig. 2 Block Diagram (Signal Generator Unit)

CIRCUIT DESCRIPTION

LEVEL INDICATOR UNIT

The level indicator unit amplified the input signal. This signal is indicated on the level meter or is applied to the pen recorder unit.

MIC AMP circuit

This circuit amplified MIC output voltage to the required level. The input impedance (R511) is 10 kΩ. The gain is adjusted by R510, R512 and VR501.

"A" filter circuit (JIS 1502)

This circuit is activated by the NOISE switch, permitting measurement of noise.

Since the output voltage through the "A" filter is lowered slightly when the circuit is activated, the voltage without passing through the filter is divided by R513 and R514 so that it remains the same when the circuit is activated.

Equalizer circuit

The equalizer circuit has a characteristic opposite the recording characteristic of the test record QR2009 of the B & K Co. It contains high-pass filter (fo = 18 Hz, 12 dB/oct). The equalizer circuit, having a RIAA curve characteristic for frequencies less than 1 kHz, consists of IC503(a), R503 through R505, C502 and C503. The high-pass filter consists of IC503(b), C504 through C506, R508 and R509.

ATT circuit

The ATT circuit consists of R521 through R529, a total of 100 kΩ.

PRE AMP circuit

The PRE AMP circuit consists of IC502, IC501(b), R532 through R535 and C515. Input signal is converted into FS 1 mV by the ATT circuit and is fed to the source follower IC502. The signal is amplified by the gain determined by R534 and R535.

Monitor AMP circuit

This circuit consists of IC507, Q504 R544 through R549, and C525 through C527. It provides output signal of FS 1 mV through output impedance of 600Ω.

FLAT AMP circuit

This circuit consists of IC504, R537 through R539, and C518 through C520. It provides output signal of FS 0.5V rms. The gain is determined by R537 and R539.

Meter AMP circuit

This circuit consists of IC505, D506 through D509, R541 through R543, VR502, and C521 through C523. It contains AC—DC converter to activate the meter. The gain is determined by R541, VR502, R503 and the internal resistance of the meter.

High-pass filter circuit

The high-pass filter circuit consists of Q505, IC506, R550 through R553, and C532 through C535. The high-pass filter (fo = 50 Hz) is activated during measurement of reverberation time.

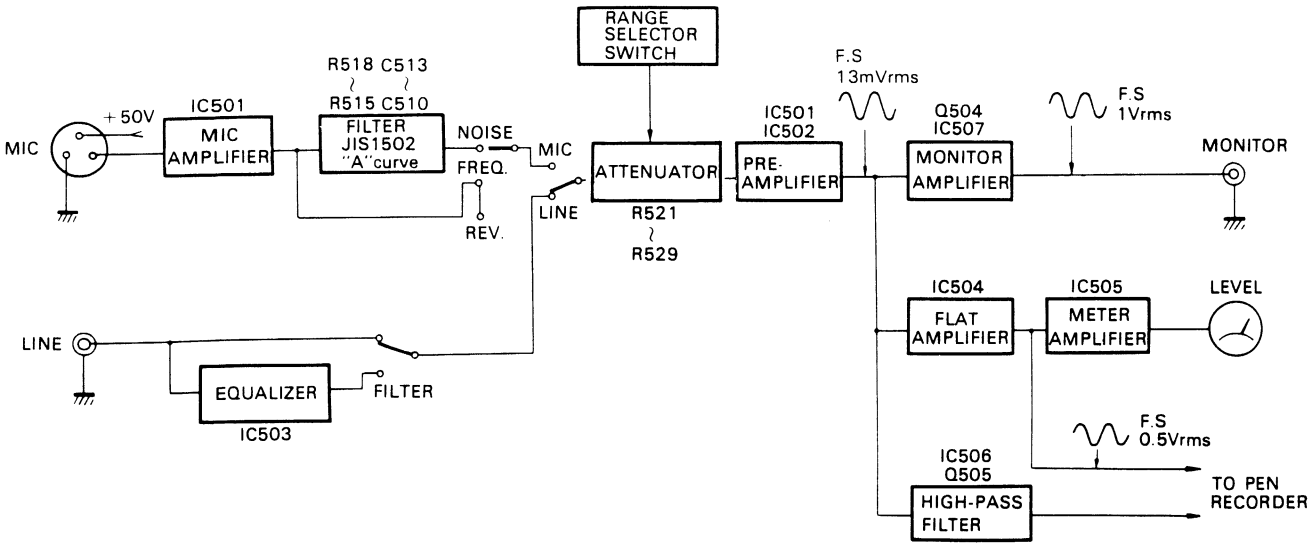


Fig. 3 Block Diagram (Level Indicator Unit)

CIRCUIT DESCRIPTION

PEN RECORDER UNIT

The pen recorder unit provides output signal to drive the pen recorder, with the signal from the level indicator unit rectified and logarithmically compressed.

AC – DC circuit

This circuit consists of IC601, IC602, D601, D602, R601 through R611, VR601, VR602, and C605 through C609. It converts AC signal from the level indicator into DC signal. C606 is a feed-forward capacitor. AC-signal is single-wave rectified by D601 and D602 and is virtually full-wave rectified by R607 and R606.

LOG circuit

The LOG circuit, consisting of IC603 through IC605, R612 through R615, VR603, VR604, VR608 and C610, logarithmically compresses DC signal. The output is −1V at 3.16V input, 0V at 0.316V and 1V at 31.6 mV. The gain is determined by R615, R617, R619, VR608 and TH601.

LEVEL SHIFT circuit

This circuit consists of IC607, R622 through R627, VR605 and VR606. It shifts the logarithmically compressed signal to the level required to drive the pen recorder. The output is 2.25V at −1V input, 1.25V at 0V and 0.25V at 1V.

+15 dB circuit

This circuit consists of IC607, R647 through R649 and VR607, and is used during measurement of reverberation time. The gain is determined by R647, R648 and VR607. The output is 2.5V at 1.75V input.

POSITION circuit

This circuit consists of IC608 and R642 through R648. It is used to shift the IC pen of the pen recorder. When the POSITION knob is set to the center position, the output is 1.25V.

High-pass filter circuit

This circuit consists of Q602, IC606(a), R651, R652, R628, R629, and C611 through C613. The high-pass filter has a characteristic of fo = 200 Hz.

PEAK HOLD circuit

This circuit consists of D604, C614 and R631. It holds the peak signal passing through the high-pass filter.

COMP circuit

This circuit consists of IC606(b), and R632 through R635. It detects the peak hold voltage of less than −20 dB and feeds it to the control circuit. The circuit is connected to the control circuit only when the EXT switch is manipulated.

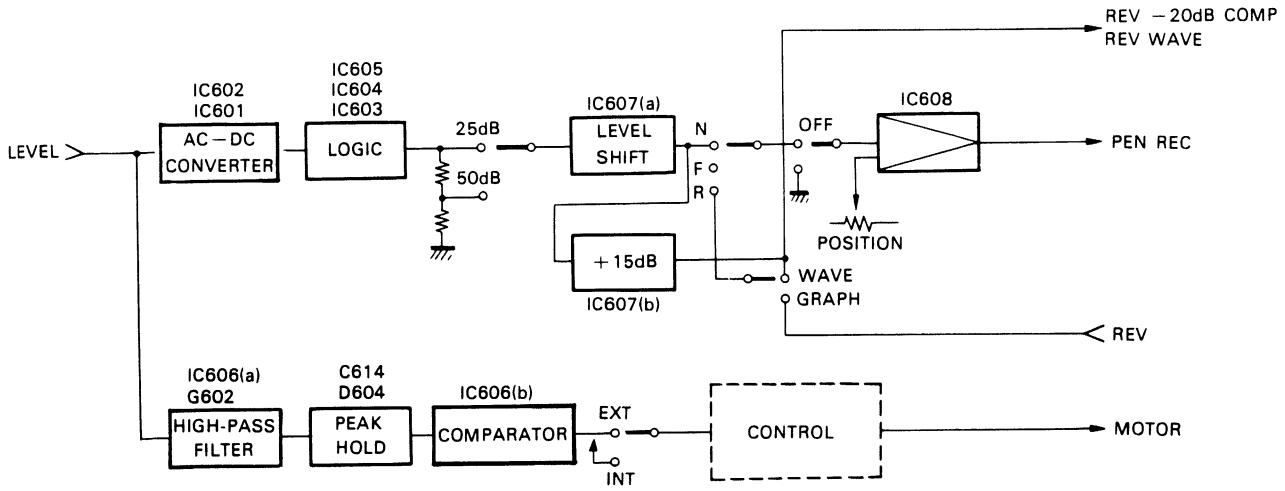


Fig. 4 Block Diagram (Pen Recorder Unit)

CIRCUIT DESCRIPTION

REVERBERATION INDICATOR UNIT

The reverberation indicator unit consists of the time integrator to measure reverberation time, −20 dB detector circuit and meter drive circuit. Reverberation time is a time at which the signal is attenuated to −60 dB. The tone butst signal from the tone burst generator is amplified to drive the speaker, and the sound wave from the speaker is fed to the microphone. The microphone signal is then amplified to the required level by the SE-3000 level indicator unit so as to be fed to the pen recorder unit. This signal is converted into DC signal and logarithmically compressed when the portion of reverberation time becomes a straight line as shown in the waveform "⑤". (Fig. 5). The comparator circuit detects the time at which the attenuation curve reaches −20 dB. The detected time is fed to the time difference detecting circuit to produce a square wave corresponding to the reverberation time, which is integrated and indicated on the meter by the meter drive circuit.

Comparator circuit

This circuit consists of IC104, R101 through R104 and VR101. The threshold value of the comparator is −20 dB when the voltage at TP101 is 1.07V.

Reference power supply circuit

This circuit consists of R119 and R120. It divides −10V from the power supply circuit to obtain time integrated reference power supply.

Time integrating circuit

This circuit consists of IC101, R107 through R109, and C101. It is connected to the analog switch to charge C101 during the presence of reverberation time.
The output voltage Et is:

$$Et = \frac{1}{C101} \int I \, dt$$

When the meter indicates full scale, the integrator output becomes 7V.

Meter drive circuit

This circuit consists of IC102, R110, R111, VR103 and C106. When the input is 2.5V, the meter indicates full scale (1 mA FS).

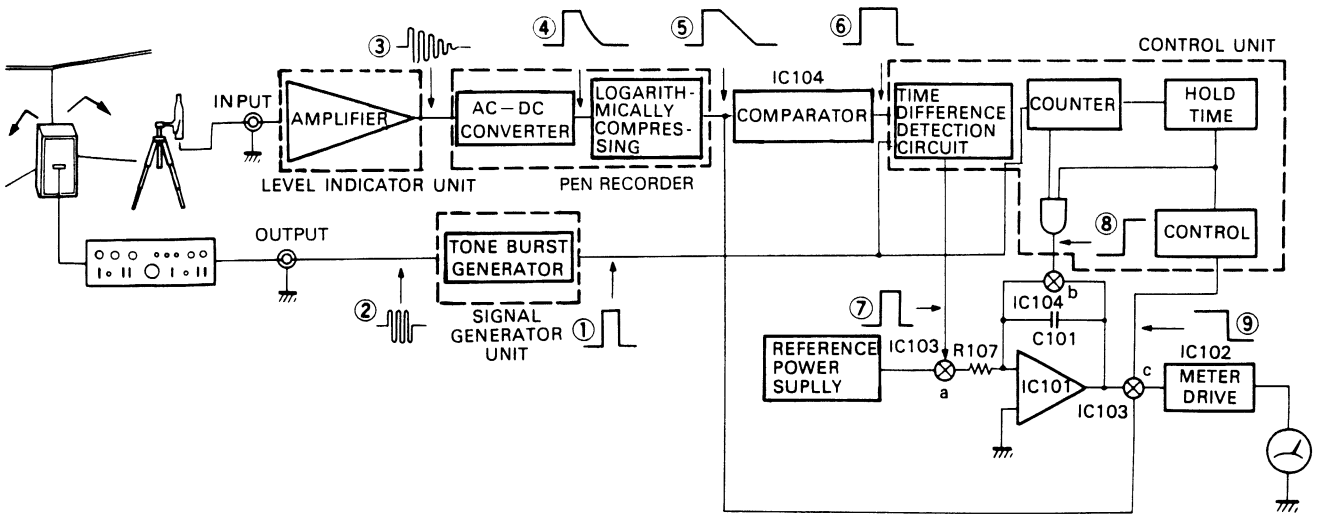


Fig. 5 Block Diagram (Reverberation Time Measurement)

CIRCUIT DESCRIPTION

CONTROL UNIT

The control unit uses TTL LS series to control all the functions of SE-3000.

Frequency response

When a start signal is applied to No. 1 pin of IC721, the one shot circuit is activated by the transient of the start signal and a 0.5 second delay is developed in IC714 because of the warming of ICpen. The counter reset of 5 and 50 seconds is released to start counting when the delay signal falls down, at which time the sweep is started. Then 5 or 50 second later, a reset pulse is given from the No. 6 pin of IC703 to reset the counter and to complete the sweep. With the start signal inputted, the heater of the IC pen turns on for warming and the pen recorder motor is driven 0.5 second later for recording. When the oscillator completes its sweep, the heater and motor stop operating. The counting time is 5 seconds at the INT position and 50 seconds at the EXT position, as selected by IC705. At the EXT position, the 0.5 second delay is not used, when the start signal is inputted, the heater and motor operate immediately.

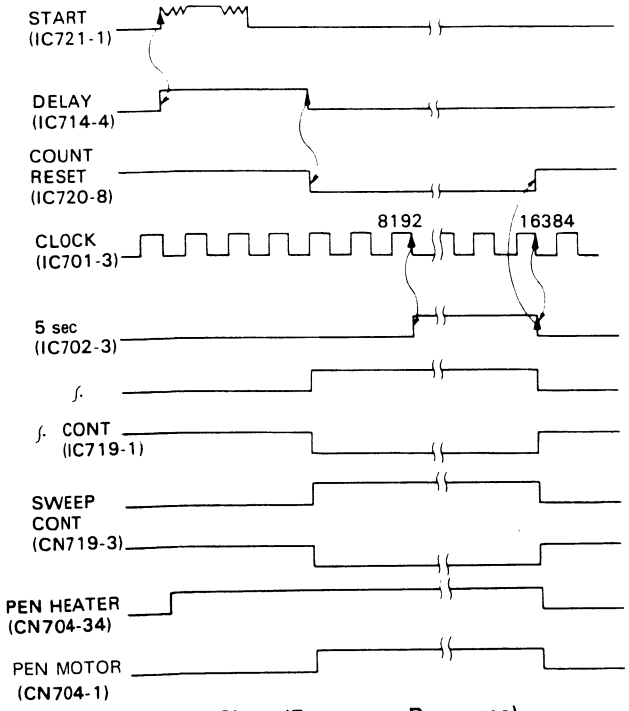


Fig. 6 Time Chart (Frequency Response)

Reverberation time

When the start signal is applied to IC721-1, the one shot circuit is activated at the beginning of the signal and a 0.5 second delay is produced by IC714. And at the end of the 0.5 second delay, IC706 is released from its reset state and a tone burst signal is outputted; at the same time, IC707 starts counting and when it has counted "5", IC714 is triggered and thus the HOLD TIME starts operating to indicate the reverberation time on the meter.

With the WAVE switch manipulated, the IC pen heater and the motor of the pen recorder operate at the end of the 0.5 second delay. The pen recorder stops at the end of the tone burst signal.

With the GRAPH switch manipulated, the IC pen heater and the motor of the pen recorder operate when the tone burst signal is completed and the HOLD TIME is started. The pen recorder stops 5 seconds later.

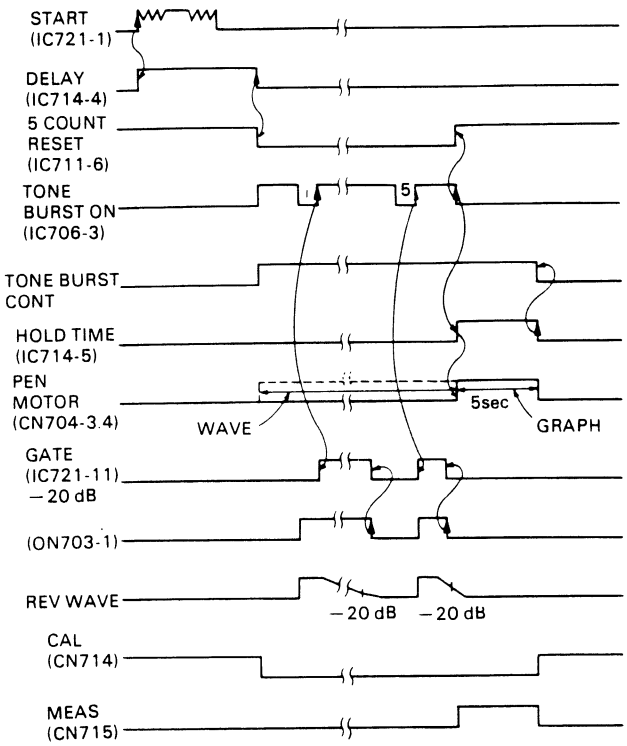


Fig. 7 Time Chart (Reverberation Time)

Clock circuit

This circuit consists of IC701 through IC704 and Q701 to produce 5 and 50 seconds. IC701 oscillates 3276.8 Hz which is divided so that 5 seconds are set by IC702 and 50 seconds by IC704.

RESET-1 circuit

This circuit consists of IC703. It generates a reset pulse after 5 or 50 seconds to clear the circuit. The RESET-1 circuit uses an integrating type differential circuit. The differential pulse width is determined by the time constant of R708 and C703.

0.5 sec DELAY circuit

This circuit uses SN74LS123N to produce 0.5 sec delay.

TONE BURST circuit

This circuit consists of IC706 to produce 0.2 sec ON and 1 sec OFF output signals.

5 COUNT circuit

This circuit uses SN74LS90. It is reset when "5" is counted.

HOLD TIME circuit

This circuit consists of IC714. It is triggered when 5 tone burst signals are outputted to hold the reverberation time of 0.8~20 sec on the meter.

CIRCUIT DESCRIPTION

RESET-2 circuit

This circuit consists of IC715. It operates the same as the RESET-1 circuit.

PULSE MOTOR CLOCK circuit

This circuit consists of IC708, IC709, IC722 and Q723. It oscilloates 1200 Hz and 120 Hz. The pen recorder operates at 30 mm/sec with 1200 Hz, and at 3 mm/sec with 120 Hz.

ERROR LATCH circuit

This circuit consists of IC717. When the 5 COUNT circuit has counted less than "5", IC717-9 becomes "H" and the ERROR lamp is lighted.

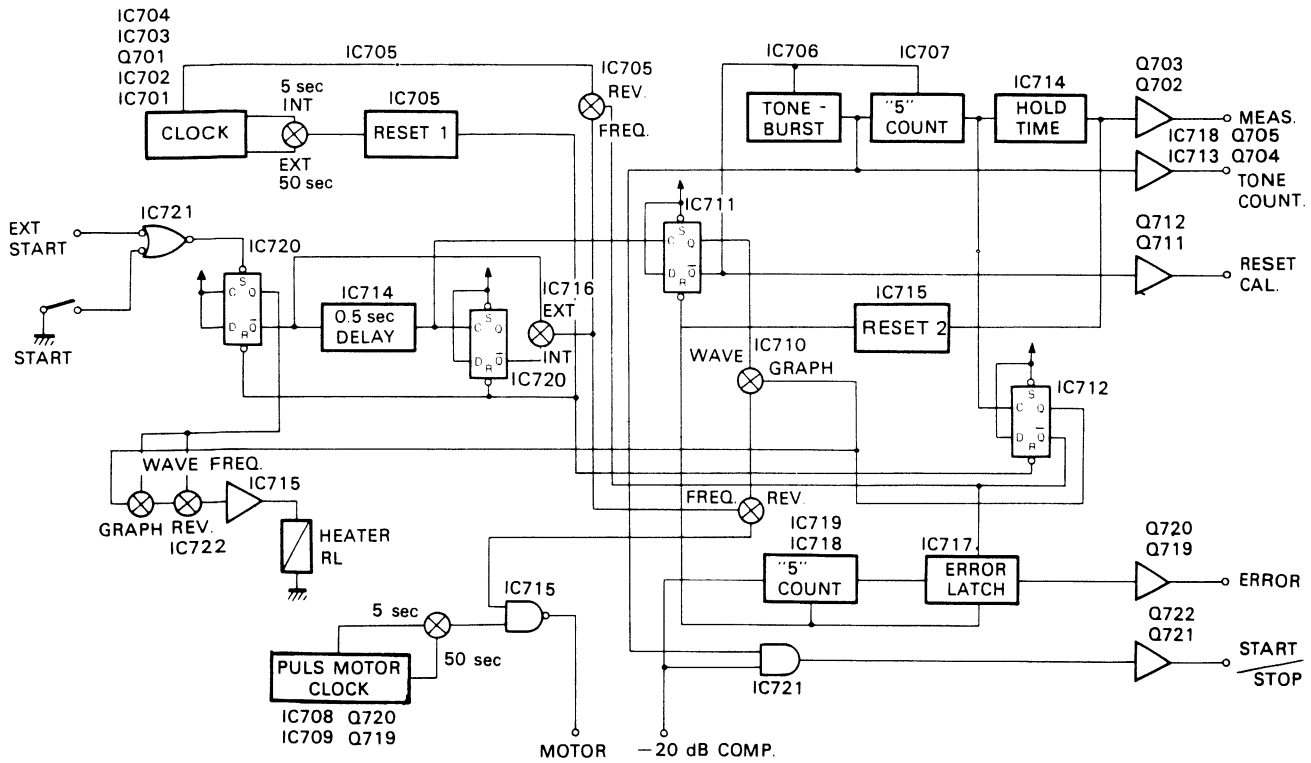
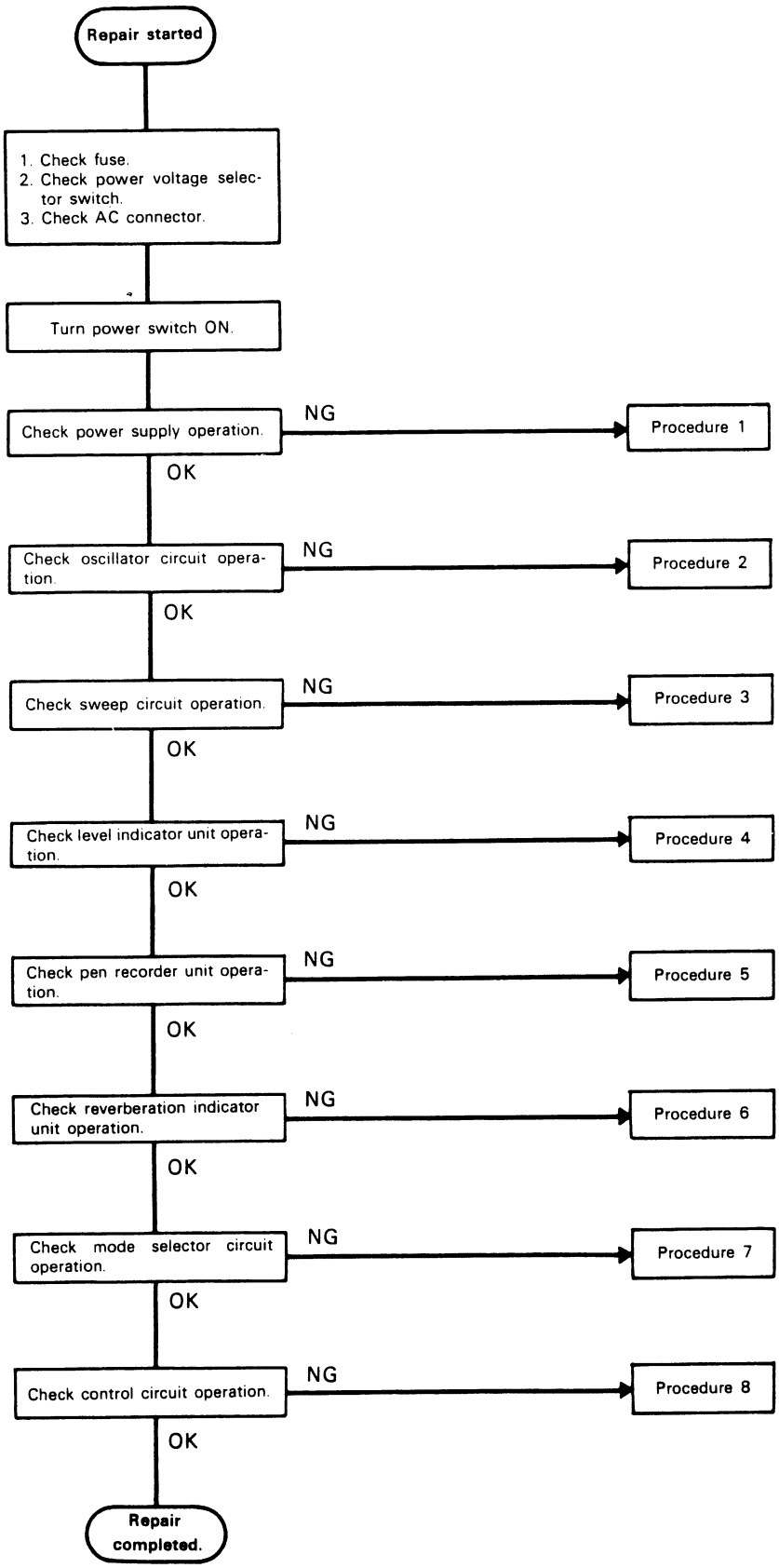
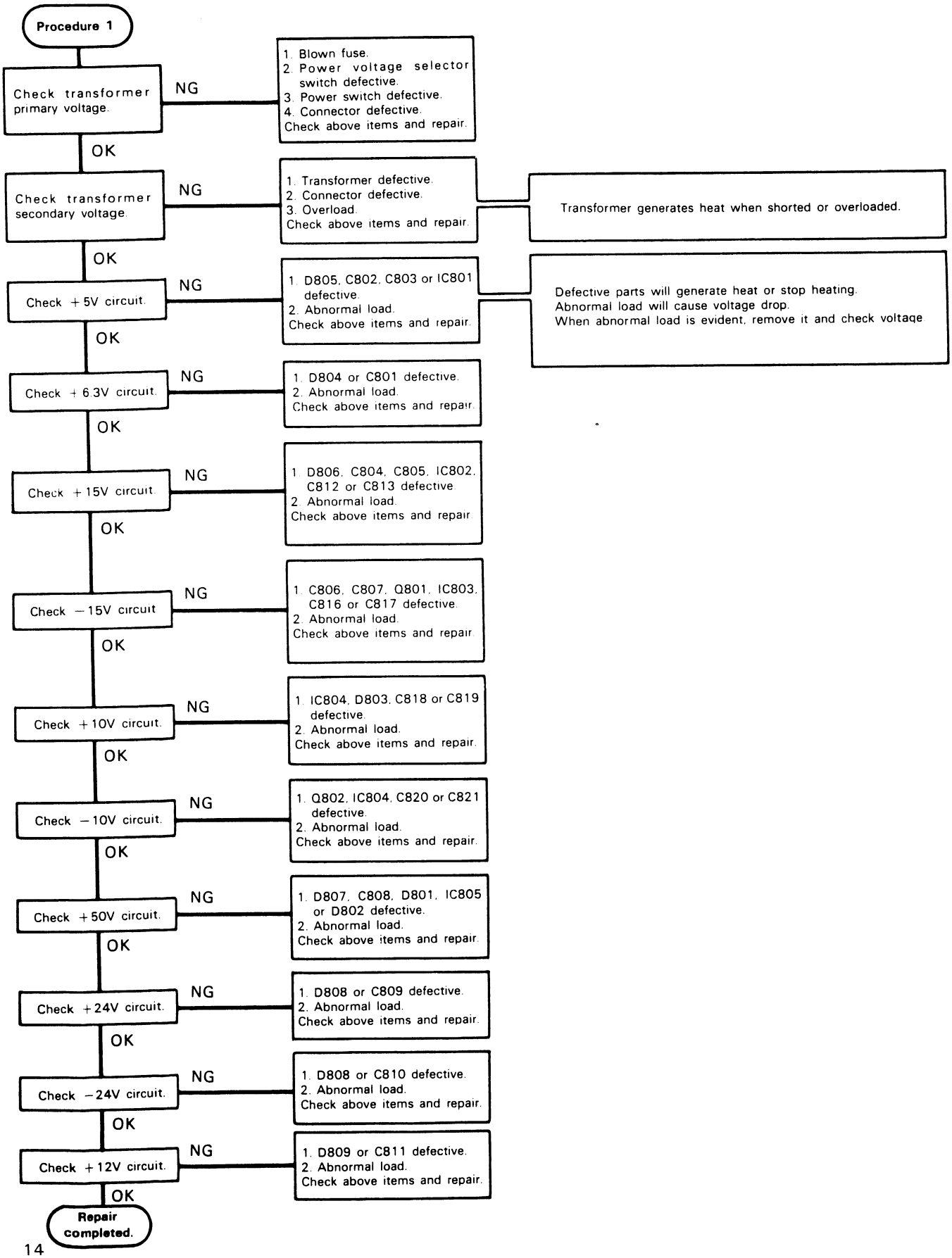


Fig. 8 Block Diagram (Control Unit)

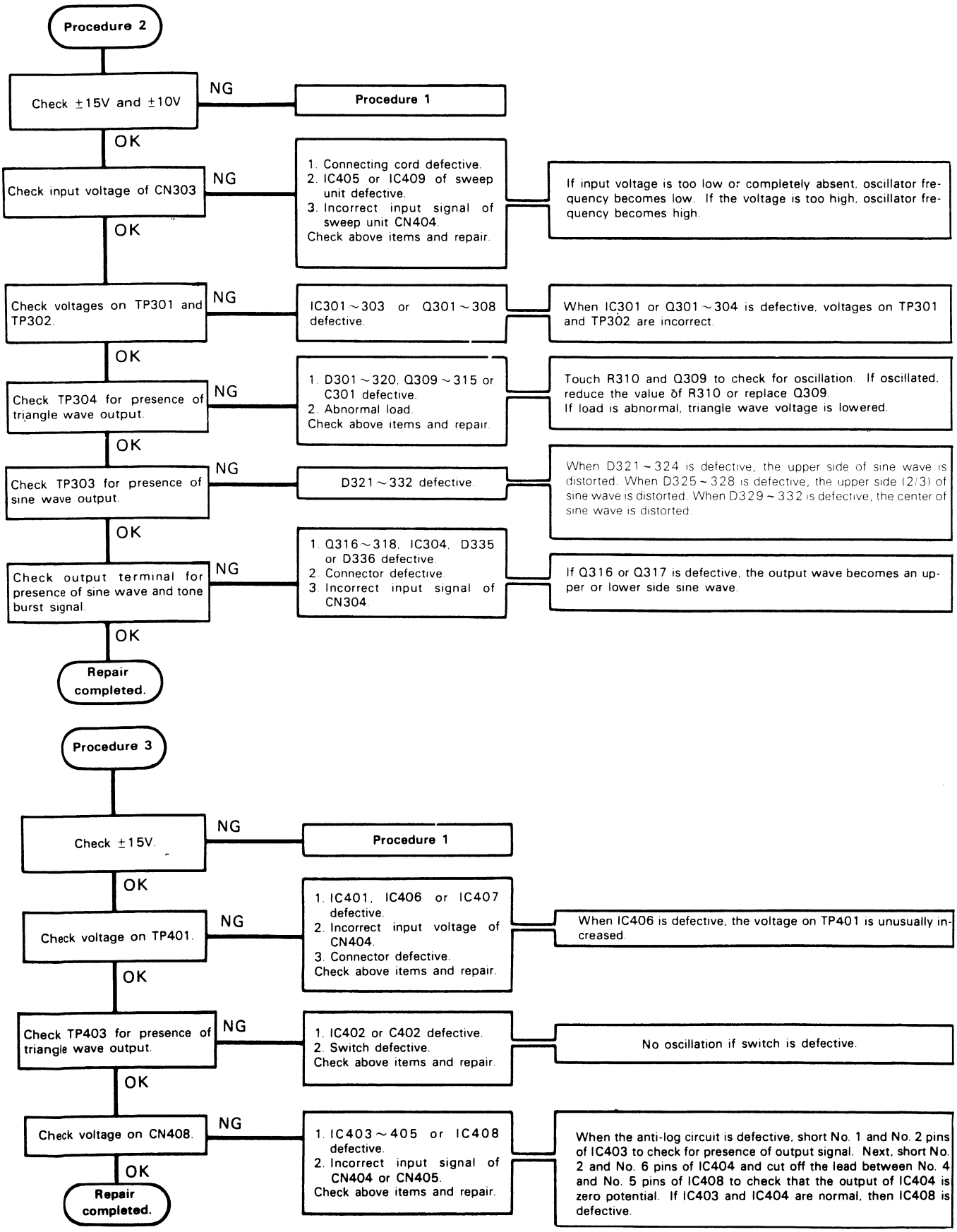
TROUBLESHOOTING



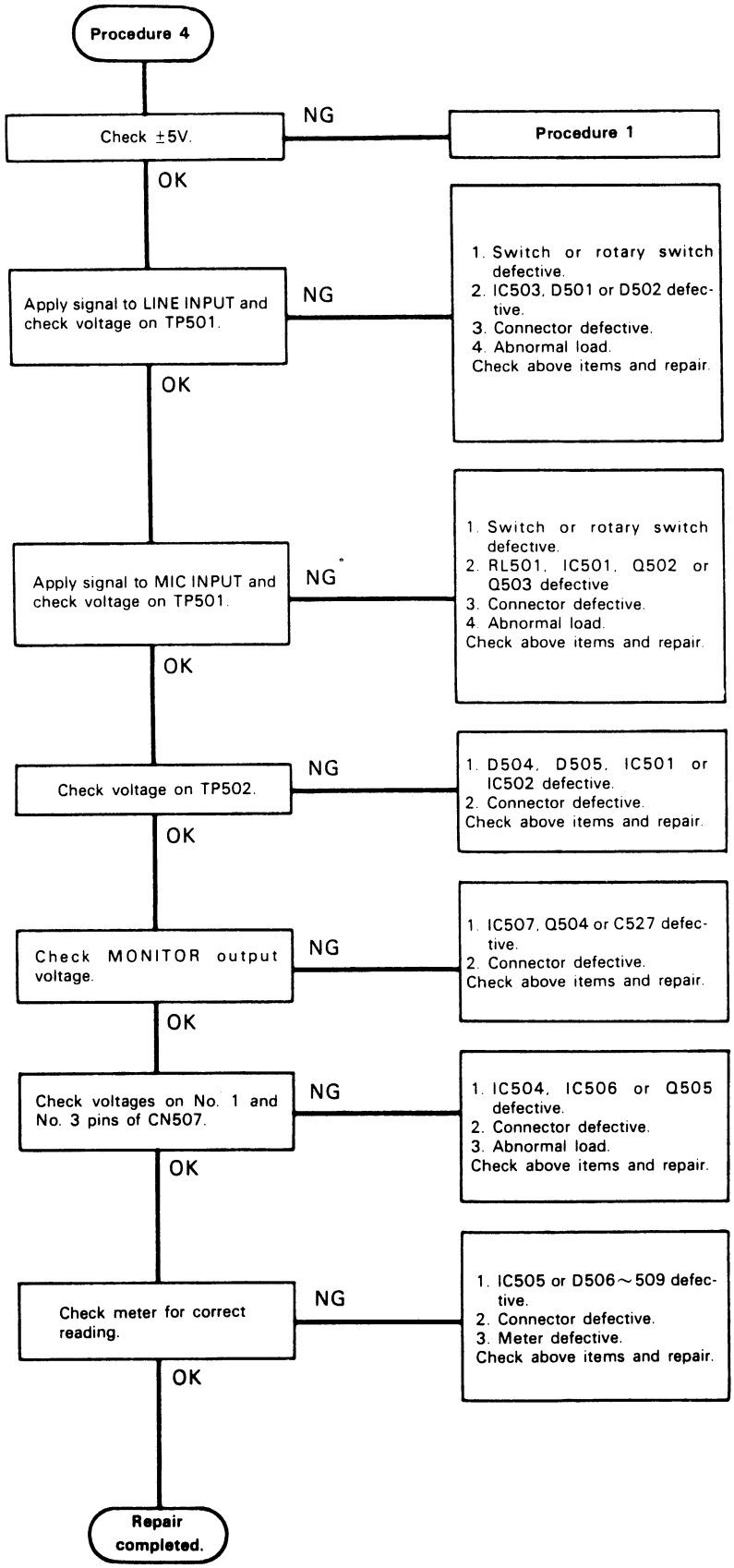
TROUBLESHOOTING



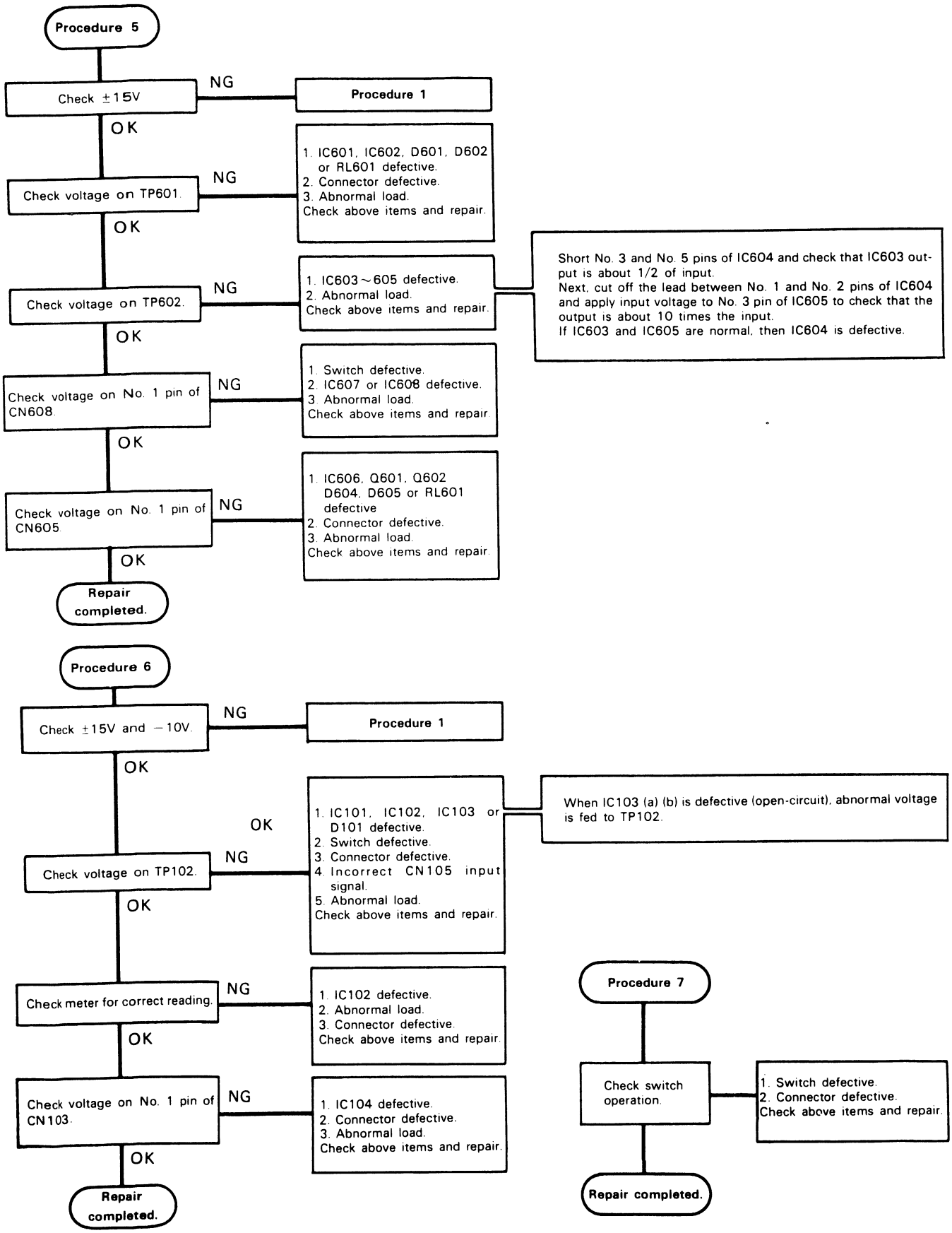
TROUBLESHOOTING


Procedure 2
Check ±15V and ±10V
NG
Procedure 1
OK
Check input voltage of CN303
NG
1. Connecting cord defective.
2. IC405 or IC409 of sweep unit defective.
3. Incorrect input signal of sweep unit CN404.
Check above items and repair.
If input voltage is too low or completely absent, oscillator frequency becomes low. If the voltage is too high, oscillator frequency becomes high.
OK
Check voltages on TP301 and TP302.
NG
IC301~303 or Q301~308 defective.
When IC301 or Q301~304 is defective, voltages on TP301 and TP302 are incorrect.
OK
Check TP304 for presence of triangle wave output.
NG
1. D301~320, Q309~315 or C301 defective.
2. Abnormal load.
Check above items and repair.
Touch R310 and Q309 to check for oscillation. If oscillated, reduce the value of R310 or replace Q309.
If load is abnormal, triangle wave voltage is lowered.
OK
Check TP303 for presence of sine wave output.
NG
D321~332 defective.
When D321~324 is defective, the upper side of sine wave is distorted. When D325~328 is defective, the upper side (2/3) of sine wave is distorted. When D329~332 is defective, the center of sine wave is distorted.
OK
Check output terminal for presence of sine wave and tone burst signal.
NG
1. Q316~318, IC304, D335 or D336 defective.
2. Connector defective.
3. Incorrect input signal of CN304.
If Q316 or Q317 is defective, the output wave becomes an upper or lower side sine wave.
OK
Repair completed.
Procedure 3
Check ±15V.
NG
Procedure 1
OK
Check voltage on TP401.
NG
1. IC401, IC406 or IC407 defective.
2. Incorrect input voltage of CN404.
3. Connector defective.
Check above items and repair.
When IC406 is defective, the voltage on TP401 is unusually increased.
OK
Check TP403 for presence of triangle wave output.
NG
1. IC402 or C402 defective.
2. Switch defective.
Check above items and repair.
No oscillation if switch is defective.
OK
Check voltage on CN408.
NG
1. IC403~405 or IC408 defective.
2. Incorrect input signal of CN404 or CN405.
Check above items and repair.
When the anti-log circuit is defective, short No. 1 and No. 2 pins of IC403 to check for presence of output signal. Next, short No. 2 and No. 6 pins of IC404 and cut off the lead between No. 4 and No. 5 pins of IC408 to check that the output of IC404 is zero potential. If IC403 and IC404 are normal, then IC408 is defective.
OK
Repair completed.

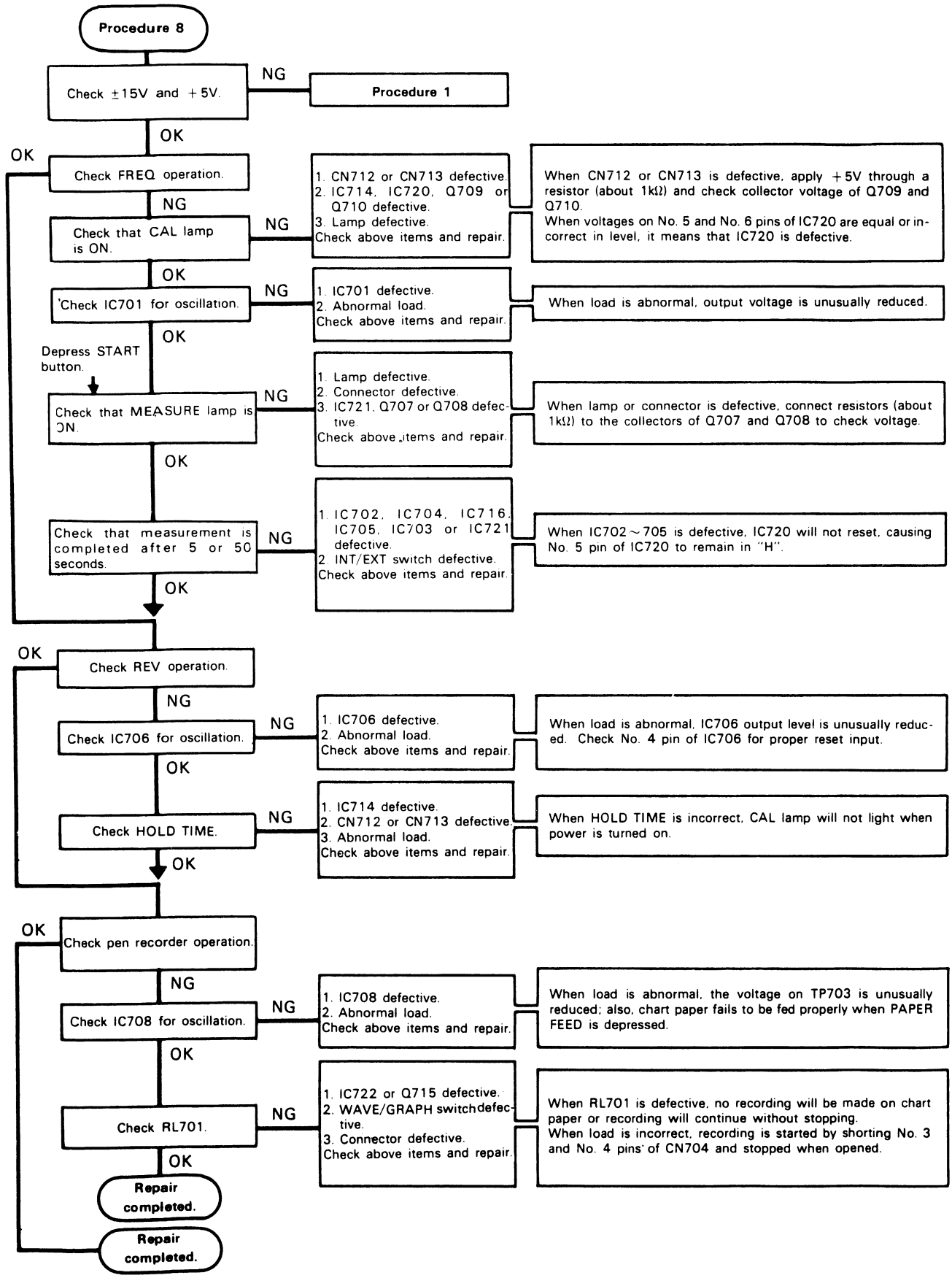
TROUBLESHOOTING



TROUBLESHOOTING

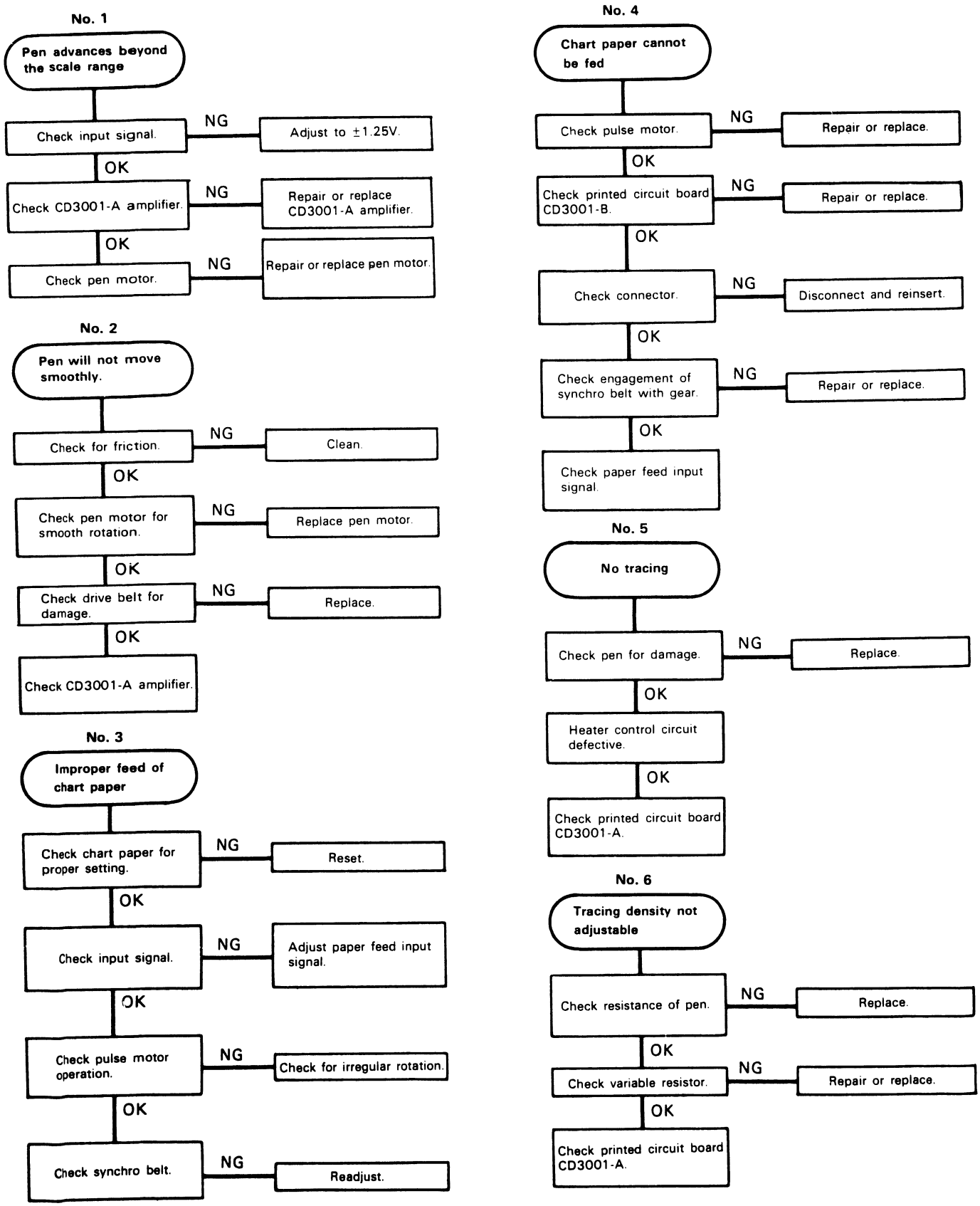

Procedure 5
Check ±15V
NG
Procedure 1
OK
Check voltage on TP601.
NG
1. IC601, IC602, D601, D602 or RL601 defective.
2. Connector defective.
3. Abnormal load.
Check above items and repair.
OK
Check voltage on TP602.
NG
1. IC603~605 defective.
2. Abnormal load.
Check above items and repair.
Short No. 3 and No. 5 pins of IC604 and check that IC603 output is about 1/2 of input.
Next, cut off the lead between No. 1 and No. 2 pins of IC604 and apply input voltage to No. 3 pin of IC605 to check that the output is about 10 times the input.
If IC603 and IC605 are normal, then IC604 is defective.
OK
Check voltage on No. 1 pin of CN608.
NG
1. Switch defective.
2. IC607 or IC608 defective.
3. Abnormal load.
Check above items and repair.
OK
Check voltage on No. 1 pin of CN605.
NG
1. IC606, Q601, Q602 D604, D605 or RL601 defective
2. Connector defective.
3. Abnormal load.
Check above items and repair.
OK
Repair completed.
Procedure 6
Check ±15V and −10V.
NG
Procedure 1
OK
OK
1. IC101, IC102, IC103 or D101 defective.
2. Switch defective.
3. Connector defective.
4. Incorrect CN105 input signal.
5. Abnormal load.
Check above items and repair.
When IC103 (a) (b) is defective (open-circuit), abnormal voltage is fed to TP102.
Check voltage on TP102.
NG
OK
Check meter for correct reading.
NG
1. IC102 defective.
2. Abnormal load.
3. Connector defective.
Check above items and repair.
OK
Check voltage on No. 1 pin of CN103.
NG
1. IC104 defective.
2. Connector defective.
3. Abnormal load.
Check above items and repair.
OK
Repair completed.
Procedure 7
Check switch operation.
1. Switch defective.
2. Connector defective.
Check above items and repair.
Repair completed.

TROUBLESHOOTING


Procedure 8
Check ±15V and +5V.
NG
Procedure 1
OK
OK
Check FREQ operation.
NG
Check that CAL lamp is ON.
NG
1. CN712 or CN713 defective.
2. IC714, IC720, Q709 or Q710 defective.
3. Lamp defective.
Check above items and repair.
When CN712 or CN713 is defective, apply +5V through a resistor (about 1kΩ) and check collector voltage of Q709 and Q710.
When voltages on No. 5 and No. 6 pins of IC720 are equal or incorrect in level, it means that IC720 is defective.
OK
'Check IC701 for oscillation.
NG
1. IC701 defective.
2. Abnormal load.
Check above items and repair.
When load is abnormal, output voltage is unusually reduced.
OK
Depress START button.
Check that MEASURE lamp is ON.
NG
1. Lamp defective.
2. Connector defective.
3. IC721, Q707 or Q708 defective.
Check above items and repair.
When lamp or connector is defective, connect resistors (about 1kΩ) to the collectors of Q707 and Q708 to check voltage.
OK
Check that measurement is completed after 5 or 50 seconds.
NG
1. IC702, IC704, IC716, IC705, IC703 or IC721 defective.
2. INT/EXT switch defective.
Check above items and repair.
When IC702~705 is defective, IC720 will not reset, causing No. 5 pin of IC720 to remain in "H".
OK
OK
Check REV operation.
NG
Check IC706 for oscillation.
NG
1. IC706 defective.
2. Abnormal load.
Check above items and repair.
When load is abnormal, IC706 output level is unusually reduced. Check No. 4 pin of IC706 for proper reset input.
OK
Check HOLD TIME.
NG
1. IC714 defective.
2. CN712 or CN713 defective.
3. Abnormal load.
Check above items and repair.
When HOLD TIME is incorrect, CAL lamp will not light when power is turned on.
OK
OK
Check pen recorder operation.
NG
Check IC708 for oscillation.
NG
1. IC708 defective.
2. Abnormal load.
Check above items and repair.
When load is abnormal, the voltage on TP703 is unusually reduced; also, chart paper fails to be fed properly when PAPER FEED is depressed.
OK
Check RL701.
NG
1. IC722 or Q715 defective.
2. WAVE/GRAPH switch defective.
3. Connector defective.
Check above items and repair.
When RL701 is defective, no recording will be made on chart paper or recording will continue without stopping.
When load is incorrect, recording is started by shorting No. 3 and No. 4 pins of CN704 and stopped when opened.
OK
Repair completed.
Repair completed.

TROUBLESHOOTING

PEN RECORDER



MAINTENANCE OF PEN RECORDER

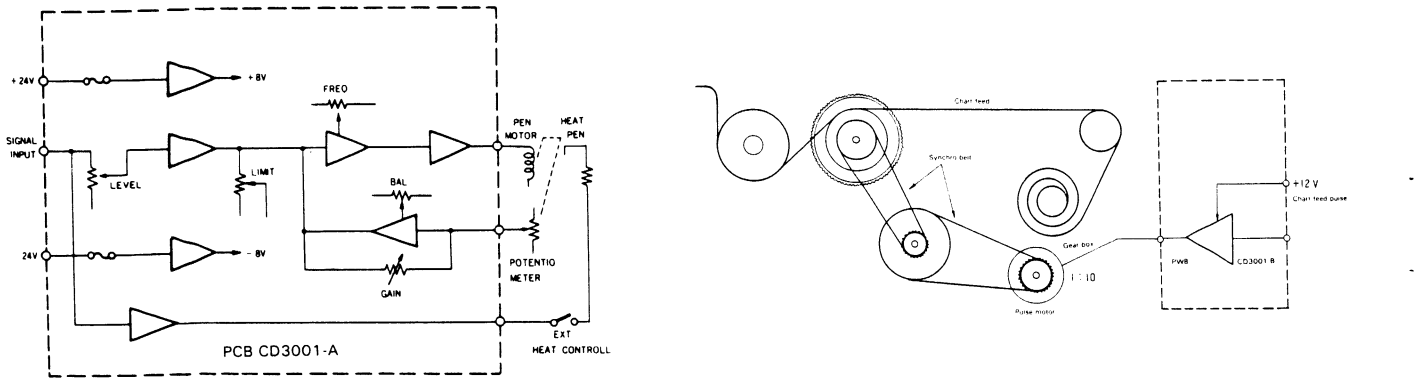


Fig. 9 Block Diagram

Check of IC pen

Check the following points. If the IC pen found to be defective, it should be replaced with a new one.

1. The chart paper is fed properly when the START button is depressed, but frequency and reverberation time cannot be recorded.
   Note: Check the HEAT for proper setting.
2. Check the tip of the IC pen for signs of damage.
3. Check that the IC pen cord is free from breaks.
4. Depress the PAPER FEED, with the No. 3 pin of the CN104 housing side (pen recorder side) and the No. 4 pin shorted, and check that the measured data are recorded on the chart paper (this should be done after the main unit has been removed from the case).
5. Check if the pin in the chart box of pen recorder is completely ON. (Micro switch is at the end of the pin .)

Replacement of IC pen

1. Remove IC pen using M1.5 Hex. wrench and replace it with a new one. Tighten new IC pen lightly.
2. Adjust the position of IC pen by shifting it carefully so that pen point moves in parallel with the chart paper.
3. Tighten IC pen securely.

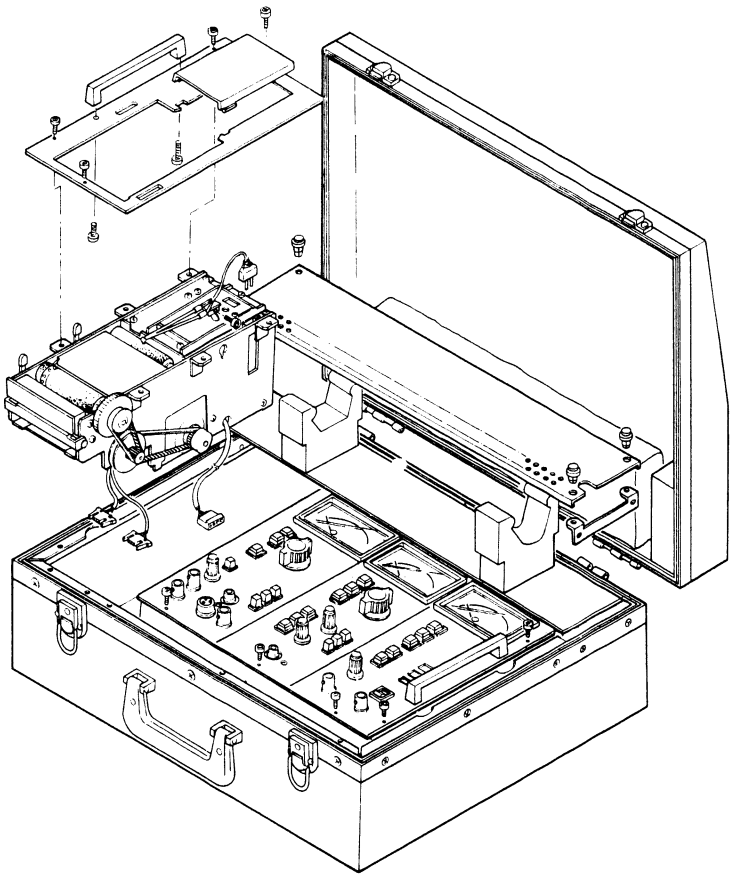


Fig. 10 Replacement of IC pen

ADJUSTMENT

INITIAL SETTING

Before the power is turned on, set the switches and knobs as follows:

SYNC → INT	WARBLE SPEED → 20 Hz
PUSH OFF → ON	LEVEL (signal generator unit) → MAX
SCALE → 50 dB	LEVEL (level indicator unit) → 0 dB
◄► POSITION → Center	FUNCTION → FREQ
INPUT MODE → LINE	REC MODE → WAVE
FILTER → OFF	F.S. SELECTOR → 1 Sec.
WARBLE SWING → OFF	HOLD TIME → MIN.

With the power turned on, the CAL lamp will light after the HOLD TIME has passed.

ADJUSTMENT OF POWER UNIT

* Adjust VR801 until −15V becomes equal to +15V.
* Adjust VR802 until −10V becomes equal to +10V.

ADJUSTMENT OF OSCILLATOR UNIT AND SWEEP UNIT

FREQUENCY switch → 16 kHz

* Adjust VR302 so that the distortion factor is best improved.
* Adjust VR305 and VR306 (tracking adjustment) until the distortion factor becomes 0.5 to 0.6%.
* Adjust VR301 for 15.9 kHz.

FREQUENCY switch → 63 Hz

* Adjust VR303 and VR304 so that the distortion factor is best improved and the frequency is close to 63 Hz.
* Adjust VR408 for 62 to 63 kHz.

FREQUENCY switch → 1 kHz

* Adjust VR305 and VR306 until the 1 kHz distortion factor reaches 0.4 to 0.5%
* Change the position of the FREQUENCY switch from 63 Hz to 1 kHz and then 333 Hz. Check frequency and distortion factor at each setting.

FREQUENCY switch → 16 kHz

* Adjust VR401 until −3V is obtained at the "common".
* Adjust VR404 and VR406 as shown in Fig. 11-Ⓑ.
  If required, make readjustment by turning VR401 slightly.

FREQUENCY switch → 1 kHz

* Adjust VR403 as shown in Fig. 11-Ⓑ.

FREQUENCY switch → 63 Hz

* Adjust VR407 as shown in Fig. 11-Ⓑ.

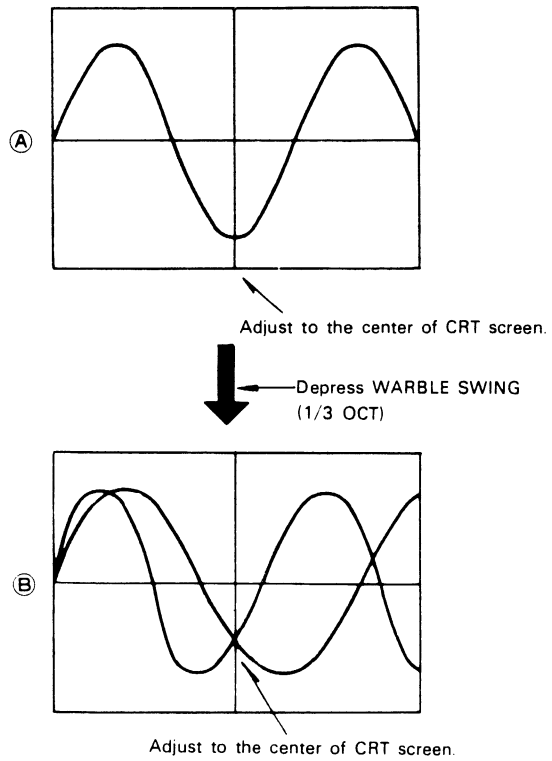


Fig. 11

FREQUENCY switch → VARI

* Turn the FREQ VARI counterclockwise and check that the frequency is 18−22 Hz. If adjustment is required, turn VR407 slightly. Next, turn the FREQ VARI fully clockwise and adjust VR307 for 19.8−20.2 kHz.

FREQUENCY switch → 16 kHz

* Adjust VR403 until the meter pointer indicates 16 kHz.
* Connect a frequency counter to TP403 and change the position of WARBLE SPEED from 5 Hz to 10 Hz and 20 Hz. Check the frequency at each setting. Next, connect an oscilloscope to TP403 and check that the triangle wave signal is about 3.2 Vp-p.
* Check the ATTENUATOR and WARBLE SWING.
* Adjust VR701 so that the frequency at TP701 (control unit) becomes 3276 Hz.
* Then, adjust VR702 so that the frequency at TP703 (control unit) becomes 386 Hz.
* Adjust VR402 so that the 20 Hz−20 kHz signal is swept in 5 seconds.
* Set the SYNC switch to EXT position and check that the 20 Hz−20 kHz signal is swept in 50 seconds.

ADJUSTMENT

ADJUSTMENT OF LEVEL INDICATOR UNIT

* Apply a reference signal of 1 Vrms 1 kHz to the LINE INPUT and set the level meter ATTENUATOR to 1V, 0 dB range.
  Adjust VR502 until the meter pointer indicates its full scale (1V).
* Next, set the ATTENUATOR to −60 dB − +20 dB range and apply a signal of 1 mV−10V to the LINE INPUT. The pointer should indicate the full scale.
* Check the MONITOR and meter frequency characteristics.
* Turn the FILTER switch ON and check the equalization characteristics. After checking, turn the switch OFF.
* Check S/N ratio with the LINE INPUT and MIC INPUT shorted.
* Connect the microphone and MIC calibrator, then adjust VR501 until the meter pointer indicates 94 dB
* Apply a signal to the MIC INPUT. Depress the NOISE switch and check the "A" curve characteristic.

ADJUSTMENT OF PEN RECORDER UNIT

* Set the ATTENUATOR of the level indicator unit to 1V, 0 dB range. Apply a signal to the LINE INPUT and adjust VR601 and VR602 so that the voltage at TP601 is as shown in Table 1 below

Table 1

LINE INPUT (AC)	TP601 (DC)
1V	1V
0.1V	0.1V
10 mV	10 mV

* With the ATTENUATOR set in 1V, 0 dB range, apply a signal to the LINE INPUT and adjust VR603 and VR604 so that the voltage at TP602 is as shown in Table 2 below.

Table 2

LINE INPUT (AC)	TP602 (DC)
3.16V	−1V
0.316V	0V
31.6 mV	+1V

* With the ATTENUATOR set in 1V, 0 dB range, apply a signal to the LINE INPUT and adjust VR605 and VR606 so that the voltage at the No. 3 pin of CN606 is as shown in Table 3 below. The SCALE should be set to 50 dB.

Table 3

LINE INPUT (AC)	No. 3 pin of CN606 (DC)
3.16V	2.25V
0.316V	1.25V
31.6 mV	0.25V

* With the ATTENUATOR set in 1V, 0 dB range, apply a signal (1V) to the LINE INPUT and adjust VR607 so that the voltage at the No. 3 pin of CN607 reaches 2.5V.
* With the ATTENUATOR set in 1V, 0 dB range, apply a signal (0.316V) to the LINE INPUT and check that the voltage at the No. 1 pin of CN608 is 1.25V. The POSITION control should be set in the center position.

ADJUSTMENT OF REVERBERATION INDICATOR UNIT

* Adjust VR101 to obtain 1.071V at TP101.
* Set the FUNCTION switch to REV position, then apply the oscillator signal to the LINE INPUT. With the signal calibrated, depress the START button. This produces five tone burst signals which are indicated on the meter. Adjust VR102 until the meter indicates 0.32 seconds.

ADJUSTMENT OF PAPER-FEED PRINTED WIRING BOARD CD3001-B

1. IC pen voltage adjustment

(A) Adjustment of printing intensity;

The printing intensity is adjusted using control HEAT adj. control. Clockwise rotation will increase the intensity, and counterclockwise rotation will decrease the intensity.

(B) Internal adjustments;

These adjustments are used when outer adjustments have no effect. (When HEAT adj. control fails to adjust the pen pressure, for example.)

a) First, remove the IC pen connector from the socket.
b) Put a dummy resistor (110 Ω, 3 W) across the IC pen socket.
c) Connect a tester across the ends of the dummy resistor. By adjusting control (B) obtain a voltage of 4 V across the resistor. Clockwise rotation of (B) will increase the voltage, and counterclockwise rotation will decrease it.
d) Plug the IC pen connector back into the socket, and feed paper out at a rate of 3 mm/sec. The intensity of the trace can now be set as HEAT adj. control above.
e) Next select the 30 mm/sec feed rate, and adjust control (A) so that there is no difference between that trace and the 3 mm/sec trace.

ADJUSTMENT

Description of Controls

HEAT adj. control: Adjust the intensity of the heater stylus.
Clockwise.....darker
Counterclockwise.....lighter

Ⓐ control: Equalises printing intensity between 30 mm/sec and 3 mm/sec printing speeds.

Ⓑ control: Maximum voltage limiter to control extra voltage to the pen when IC6 is changed, or after any repairs to the power source.

2. Limiter adjustment

a) With ZERO adj. control, deflect the pen towards (+) side.
b) By adjusting control Ⓒ, situate the pen tip 2 mm approximately outside the available recording space.
c) With ZERO adj. control, deflect the pen to the (−) side. Adjust control LIMIT adj. control to locate the pen tip approximately 2 mm outside the available recording space.

3. Sensitivity adjustment

a) Place a tester across control Ⓔ, and adjust till a reading of 12 kΩ is obtained.
b) Connect an input voltage of 1 V to the external input terminal, and adjust Ⓓ control to give a 10 mm deflection of the pen.
c) With the same input voltage, obtain a 20 mm deflection by adjusting control Ⓔ.

4. Adjustment of frequency response

a) Rotate FREQ adj. control fully clockwise.
b) Using a low frequency oscillator, add a 1 Hz 2 V p - p signal across the input terminal.
c) Adjust the oscillator output to give a 50 mm pen deflection p - p.
d) Feed recording paper at 30 mm/sec and increase the oscillator frequency to 30 Hz.
e) Adjust control Ⓓ to give a deflection width of 48 mm to 49 mm p - p.

5. Adjustment of paper transfer noise level

a) Place an ammeter across the paper feed power source (+12 V) line.
b) Set the paper feed motor to 30 mm/sec feed rate, and adjust control Ⓕ to give a current of 0.5 A on the power line. (Clockwise rotation increases power.)
c) Feed paper out at both 3 mm/sec and 30 mm/sec and check the noise level. If it is too noisy, adjust control Ⓕ until a satisfactory noise level is reached.

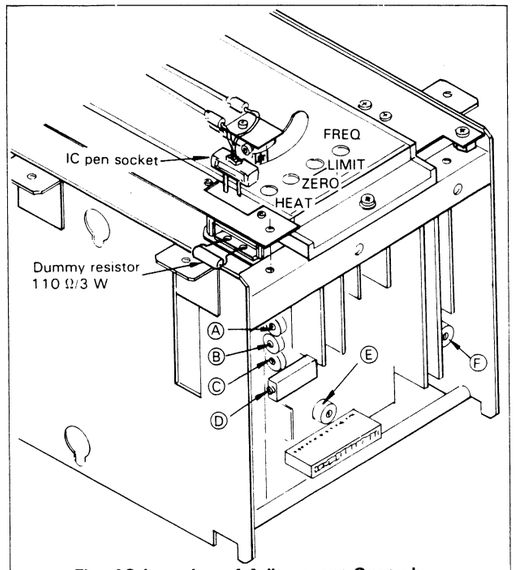
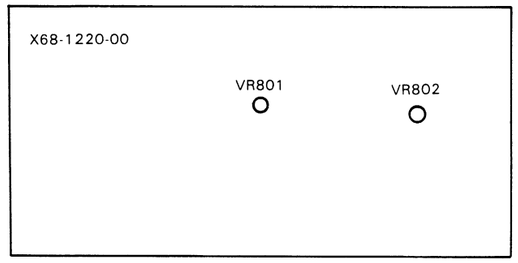


Fig. 12 Location of Adjustment Controls

X68-1220-00



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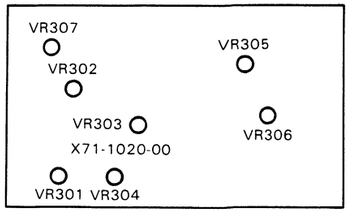

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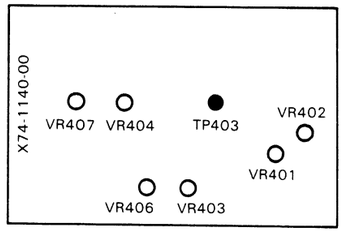

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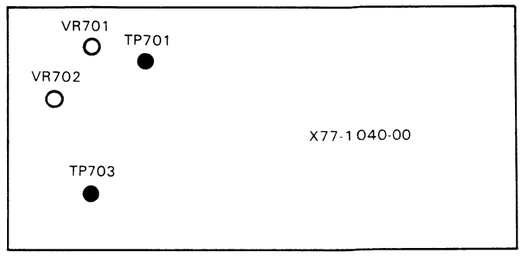

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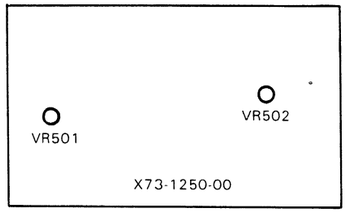

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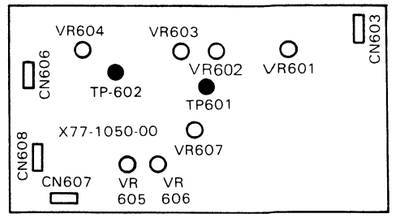

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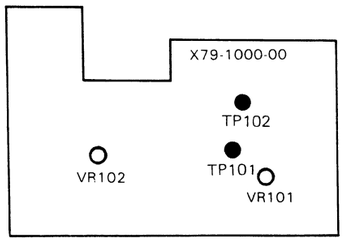


Location of Adjustment Control

CHECK SHEET

Defect ratio $= \frac{\text{Unit}}{\text{Unit}} \times 100 =$ ___[%] Number of defectx ___ Ambient temperature ___[°C] Humidity ___[%]

Note: 1. Check each item using the quality inspection standard as a guide.
2. Mark each check item with OK or NG. Enter figures in the unit columns (dB, Hz, %, etc.)

	No.	Check Item / Serial No.		I
COMMON	1	Packing: Stain, damage, indication		
	2	Accessory: Proper quantities		
	3	Appearance: Stain, damage		
	4	Switch operation		
	5	Control knob operation		
	6	Tripod cover mounting latch		
	7			
	8			
	9	Frequency response		dB
OSCILLATOR UNIT	10	OSCILLATING FREQUENCY	63Hz	Hz
	11		125Hz	Hz
	12		250Hz	Hz
	13		500Hz	Hz
	14		1kHz	Hz
	15		2kHz	Hz
	16		4kHz	Hz
	17		8kHz	Hz
	18		16kHz	Hz
	19		20Hz	Hz
	20		20kHz	Hz
	21	DISTORTION FACTOR	63Hz	%
	22		125Hz	%
	23		250Hz	%
	24		500Hz	%
	25		1kHz	%
	26		2kHz	%
	27		4kHz	%
	28		8kHz	%
	29		16kHz	%
	30		20Hz	%

	No.	Check Item / Serial No.		I
OSCILLATOR UNIT	31		20kHz	%
	32	ATT	0dB	Vrms
	33		−20dB	Vrms
	34		−40dB	Vrms
	35	WARBLE SWING	OFF	
	36		1/3 OCT	
	37		1 OCT	
	38	WARBLE SPEED	5Hz	
	39		10Hz	
	40		20Hz	
	41	FREQUENCY METER linearity		
	42	LEVEL METER ACCURACY	1mV	mV
	43		3mV	mV
	44		10mV	mV
	45		30mV	mV
	46		0.1V	V
	47		0.3	V
	48		1V	V
	49		3V	V
	50		10V	V
LEVEL INDICATOR UNIT	51	MONITOR frequency response		
	52	LEVEL METER frequency response		
	53	FILTER curve		
	54	NOISE "A" curve		
	55	LIN S/N		dB
	56	MIC S/N		dB
	57	LEVEL METER linearity		
	58	MIC sensitivity		
	59			
	60			

	No.	Check Item / Serial No.	I
PEN RECORDER	61	INT/EXT operation	
	62	PUSH OFF operation	
	63	PAPER FEED operation	
	64	SCALE 25dB, 50dB	
	65	POSITION operation	
	66	Heater operation	
	67	Pen recorder linearity	
	68	Paper feed operation	
	69	SCOPE V(DC) H(⩘)	
	70	Rewind roller	
	71	Paper-up lever	
	72	Limiter	
	73	Recording density	
	74		
	75		
REVERBERATION TIME	76	WAVE operation	
	77	GRAPH operation	
	78	SCALE 1sec/2sec	
	79	HOLD TIME	
	80	REVERBERATION METER	
	81	REV. WAVE	
	82	SYNC. OUTPUT	
	83		
	84		
CONTROL	85	CAL	
	86	MEASURE	
	87	ERROR	
	88	Sweep frequency	
	89	Tone burst wave	
	90		

PARTS LIST

Fig. & Index No.	Parts No.	Description
1-1	K01-0506-05	Handle × 2
1-2	F07-0906-13	Protective cover
1-3	A20-2730-13	Decorative panel
1-4	A20-2729-22	Decorative panel
1-5	B07-0122-04	Push escutcheon × 14
1-6	B07-0105-04	Push escutcheon × 8
1-7	K21-0812-04	Knob × 2
1-8	K21-0306-04	Knob × 4
1-9	S36-0501-15	Toggle switch (POWER)
1-10	N08-0607-05	Hex socket head screw × 11
1-11	N10-2040-46	Hex nut × 9
1-12	B38-0403-05	Pen recorder
1-13	B31-0713-05	Meter (LEVEL)
1-14	B31-0714-05	Meter (FREQUENCY)
1-15	B31-0715-05	Meter (REVERBERATION)
1-16	A13-0720-03	Decorative frame
1-17	A20-1424-22	Chassis
1-18	A13-0719-13	Frame
1-19	A09-0502-12	Attache case
1-20	J21-2878-14	Bracket for cover
1-21	F07-0910-12	Accessory compartment cover
1-22	J59-0001-05	Grommet
1-23	J59-0002-05	Plunger
1-24	J19-1628-04	Paper retainer
1-25	B40-0765-14	Serial number plate
1-26	X68-1220-00	Power supply unit
	J25-2845-03	Printed circuit board
1-27	F01-0813-05	Heat sink
1-28	X84-1030-00	Meter protection unit
	J25-2858-04	Printed circuit board
1-29	B07-0111-04	Ring
2-1	E04-0252-05	Receptacle for MIC
2-2	E04-0251-05	Receptacle for BNC
2-3	E03-0201-05	Connector for power
2-4	E21-0657-04	Metal terminal
2-5	J13-0033-15	Fuse holder
2-6	F05-5013-05	Fuse 0.5A
2-7	B19-0702-04	Filter
2-8	F15-0707-14	Blind rubber
2-9	B30-0908-05	Lamp ass'y
2-10	E09-0681-05	Voltage selector plug
2-11	E08-1081-05	Voltage selector receptacle
2-12	X77-1020-00	Voltage selector unit
2-13	R03-7501-05	Variable res. 50kΩB × 2
2-14	E13-0115-15	Pin jack
2-15	E23-0513-05	Earth lug × 5
2-16	F10-1531-04	Shield plate
2-17	F10-1532-04	Shield plate
2-18	K21-0292-14	Push knob (orange) × 10
2-19	K21-0807-04	Push knob (blue) × 3
2-20	K21-0282-04	Push knob (gray) × 5
2-21	K21-0293-14	Push knob (blue) × 4
2-22	K21-0823-04	Knob
2-23	R03-0501-05	Variable res. 200ΩB
2-24	R03-1504-05	Variable res. 2kΩB
2-25	S40-1501-05	Push switch
2-26	L01-9296-05	Power transformer
2-27	J21-2860-13	Mounting hardware for power transformer
2-28	X77-1050-00	Pen recorder unit
	J25-2843-03	Printed circuit board
2-29	X73-1250-00	Level indicator unit
	J25-2842-05	Printed circuit board
2-30	X74-1140-00	Sweep unit
	J25-2840-03	Printed circuit board
2-31	X77-1040-00	Control unit
	J25-2843-03	Printed circuit board

Fig. & Index No.	Parts No.	Description
2-32	X71-1020-00	Signal generator unit
	J25-2838-03	Printed circuit board
2-33	X84-1020-00	Mode selector unit
	J25-2839-03	Printed circuit board
2-34	X79-1000-00	Reverberation indicator unit
	J25-2841-03	Printed circuit board
2-35	S42-4502-05	Push switch
2-36	J21-2861-12	Bracket for P.C.B.
2-37	J21-2862-02	Bracket for P.C.B.
2-38	J21-2863-12	Bracket for P.C.B.
2-39	J21-2864-14	Bracket for P.C.B.
2-40	J21-2865-04	Bracket for P.C.B.
2-41	F10-1533-04	Shield plate
2-42	F11-0147-24	Shield plate
2-43	S01-1509-05	Rotary switch
2-44	S42-3504-05	Push switch
2-45	S42-3501-05	Push switch
2-46	S01-2506-15	Rotary switch
2-47	S42-3501-05	Push switch
2-48	S42-2504-05	Push switch
2-49	S42-3502-05	Push switch
2-50	S40-1502-05	Push switch
	B42-1802-04	Cushion for IC pen
	B41-0717-14	Voltage indication plate
	B43-0701-04	TRIO badge
	B50-2864-10	Instruction manual
	E30-0554-25	Lead w/connector
	E31-0507-15	Lead w/connector
	E31-0532-05	Lead w/connector
	E31-0598-05	Lead w/connector
	E31-0599-05	Lead w/connector
	E31-0600-05	Lead w/connector
	E31-0601-05	Lead w/connector
	E31-0602-05	Lead w/connector
	E31-0603-05	Lead w/connector
	E31-0604-05	Lead w/connector
	E31-0605-05	Lead w/connector
	E31-0606-05	Lead w/connector
	E31-0607-05	Lead w/connector
	E31-0608-05	Lead w/connector
	E31-0609-05	Lead w/connector
	E31-0610-05	Lead w/connector
	E31-0611-05	Lead w/connector
	E31-0612-05	Lead w/connector
	E31-0613-05	Lead w/connector
	E31-0614-05	Lead w/connector
	E31-0615-05	Lead w/connector
	E31-0616-05	Lead w/connector
	E31-0617-05	Lead w/connector
	E31-0618-05	Lead w/connector
	E31-0619-05	Lead w/connector
	E31-0620-05	Lead w/connector
	E31-0621-05	Lead w/connector
	E31-0622-05	Lead w/connector
	E31-0623-05	Lead w/connector
	E31-0624-05	Lead w/connector
	E31-0625-05	Lead w/connector
	E31-0626-05	Lead w/connector
	E31-0671-05	Lead w/connector
	E31-0672-05	Lead w/connector
	E30-1818-05	JIS power cord
	E30-1819-05	CEE power cord

PARTS LIST

Fig. & Index No.	Parts No.	Description
	E30-1820-05	UL/CSA power cord
	E30-1821-05	SAA power cord
	E07-0361-05	MIC connector
	E14-0001-05	Pin plug
	J09-0501-05	MIC stand
	J21-0392-04	Leadwire holder
	J61-0049-05	Cable band
	T91-0401-05	Microphone
	H01-2851-14	Packing case
	H12-0519-02	Packing material formed stylene
	H12-0520-13	Packing material
	H12-0521-04	Packing material
	H20-1710-04	Pad
	H25-0708-04	Polyethylene bag
	H19-0505-04	Accessory box
	H19-0503-04	Accessory box
	H25-0029-04	Polyethylene bag
	CE02W1C470	Electrolytic cap. 47μF 16WV
	N10-2030-46	Hex nut × 7
	N16-0050-46	Spring washer × 4
	N17-1030-46	Lock washer
	N30-3008-41	Pan-head screw
	N30-3010-41	Pan-head screw × 2
	N30-5010-46	Pan-head screw × 4
	N32-3008-46	Flat-head screw × 6
	N32-3006-46	Flat-head screw × 4
	N32-3010-46	Flat-head screw × 4
	N33-3012-41	Flat-head screw × 4
	N33-4014-41	Flat-head screw × 9
	N88-3008-41	Tapping screw × 5
	N89-3006-46	Tapping screw × 41
	N89-3008-41	Tapping screw × 2

LEVEL INDICATOR UNIT (X73-1250-00)

Ref.No	Parts No.	Description
R501	RD14BB2E104J	100kΩ 1/4W ±5% Carbon res.
R502	RD14BY2H102J	1kΩ 1/2W ±5% Carbon res.
R503	RN14BK2E4301F	430Ω 1/4W ±1% Metal film res.
R504	RN14BK2E1502F	15kΩ 1/4W ±1% Metal film res.
R505	RN14BK2E1603F	160kΩ 1/4W ±1% Metal film res.
R508	RN14BK2E4302G	43kΩ 1/4W ±2% Metal film res.
R509	RN14BK2E1903G	190kΩ 1/4W ±2% Metal film res.
R510	RN14BK2E7500G	750Ω 1/4W ±2% Metal film res.
R511	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R512	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
R513	RN14BK2E3001F	3kΩ 1/4W ±1% Metal film res.
R514	RN14BK2E1501F	1.5kΩ 1/4W ±1% Metal film res.
R515,516	RN14BK2E1801F	1.8kΩ 1/4W ±1% Metal film res.
R517	RN14BK2E1002F	10kΩ 1/4W ±1% Metal film res.
R518	RN14BK2E1003F	100kΩ 1/4W ±1% Metal film res.
R519,520	RD14BB2E223J	22kΩ 1/4W ±5% Carbon res.
R521	RN14BK2E10R0D	10Ω 1/4W ±0.5% Metal film res.
R522	RN14BK2E21R8D	21.8Ω 1/4W ±0.5% Metal film res.
R523	RN14BK2E68R7D	68.7Ω 1/4W ±0.5% Metal film res.
R524	RN14BK2E2170D	217Ω 1/4W ±0.5% Metal film res.
R525	RN14BK2E6880D	688Ω 1/4W ±0.5% Metal film res.
R526	RN14BK2E2181D	2.18kΩ 1/4W ±0.5% Metal film res.
R527	RN14BK2E6991D	6.99kΩ 1/4W ±0.5% Metal film res.
R528	RN14BK2E2232D	223kΩ 1/4W ±0.5% Metal film res.

Ref.No	Parts No.	Description
R529	RN14BK2E6802D	68kΩ 1/4W ±0.5% Metal film res.
R530	RD14BY2H102J	1kΩ 1/2W ±5% Carbon res.
R531	RD14BB2E105J	1MΩ 1/4W ±5% Carbon res.
R532,533	RN14BK2E5101G	5.1kΩ 1/4W ±2% Metal film res.
R534	RN14BK2E6801G	6.8kΩ 1/4W ±2% Metal film res.
R535	RN14BK2E9101G	91kΩ 1/4W ±2% Metal film res.
R536	RD14BB2E821J	820Ω 1/4W ±5% Carbon res.
R537	RN14BK2E1001G	1kΩ 1/4W ±2% Metal film res.
R538	RD14BB2E104J	100kΩ 1/4W ±5% Carbon res.
R539	RN14BK2E3302G	33kΩ 1/4W ±2% Metal film res.
R540	RD14BB2E681J	680Ω 1/4W ±5% Carbon res.
R541	RN14BK2E3600G	360Ω 1/4W ±2% Metal film res.
R542	RD14BB2E104J	100kΩ 1/4W ±5% Carbon res.
R543	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R544	RN14BK2E1001G	1kΩ 1/4W ±2% Metal film res.
R545	RD14BB2E104J	100kΩ 1/4W ±5% Carbon res.
R546	RN14BK2E6802G	68kΩ 1/4W ±2% Metal film res.
R547	RD14BB2E392J	3.9kΩ 1/4W ±5% Carbon res.
R548	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R549	RS14AB3A561J	560Ω 1W ±5% Metal oxide film res.
R550	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R551	RD14BB2E182J	1.8kΩ 1/4W ±5% Carbon res.
R552	RN14BK2E7501G	7.5kΩ 1/4W ±2% Metal film res.
R553	RN14BK2E3302G	33kΩ 1/4W ± 2% Metal film res.
VR501	R12-1031-05	2.2kΩB Semi-fixed res.
VR502	R12-0504-05	220ΩB Semi-fixed res.
C501	C91-0521-05	2.2μF 100WV± 10% Metalized film cap.
C502	CE04W1A101	100μF 10WV Electrolytic cap.
C503	C91-0527-05	0.015μF 100WV± 1% Polypropylen cap.
C504 ~ 506	CQ93M1H104J	0.1μF 50WV ±5% Polyester cap.
C507	CE04W1A101	100μF 10WV Electrolytic cap.
C509	CE04W1A330	33μF 10WV Electrolytic cap.
C510,511	C91-0522-05	0.33μF 100WV± 1% Polypropylen cap.
C512	C91-0523-05	0.47μF 100WV± 1% Polypropylen cap.
C513	C91-0524-05	2200pF 100WV± 1% Polypropylen cap.
C514	C91-0521-05	2.2μF 100WV± 1% Polypropylen cap.
C515	CE04W1A330	33μF 10WV Electrolytic cap.
C516,517	CE04W1C101	100μF 16WV Electrolytic cap.
C518,519	CE04W1A101	100μF 10WV Electrolytic cap.
C520	CC45SL1H020D	2pF 50WV ±0.5pF Ceramic cap.
C521	CE04W1C221	220μF 16WV Electrolytic cap.
C522	CE04W1A100	10μF 10WV Electrolytic cap.
C523	CC45SL1H030D	3pF 50WV ±0.5pF Ceramic cap.
C524	CE04W1A101	100μF 10WV Electrolytic cap.
C525	CE04W1A100	10μF 10WV Electrolytic cap.
C526	CC45SL1H050D	5pF 50WV ±0.5pF Ceramic cap.
C527	CE04W1E101	100μF 25WV Electrolytic cap.
C528	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C529	CE04W1E101	100μF 25WV Electrolytic cap.
C530	CK45B1H103K	0.01μF 50WV± 10% Ceramic cap.
C531	CE04W1E101	100μF 25WV Electrolytic cap.
C532 ~ 534	CQ93M1H104J	0.1μF 50WV ±5% Polyester film cap.
C535	CC45SL1H030D	3pF 50WV ±0.5pF Ceramic cap.
C536	CC45SL1H331J	330pF 50WV ±5% Ceramic cap.
IC501		IC NJM4558D
IC502		IC 2SK185-2-(M)
IC503		IC NJM4558D
IC504 ~ 507		IC CA301AG
Q502,503		FET 2SK30A (O)
Q504,505		Transistor 2SC945 (Q)

PARTS LIST

Ref.No	Parts No.	Description
D501 ~ 509		Diode 1S1555
TP501,502	E23-0512-05	1P Pin-connector
CN501 ~ 503	E40-0364-05	3P Pin-connector
CN504	F40-0403-05	4P Pin-connector
CN505 ~ 507	E40-0364-05	3P Pin-connector
RL501	S51-1020-05	Relay
	F10-1533-04	Shield plate
	F11-0147-24	Shield case
	F11-0936-04	Shield case
	J25-2842-05	Printed circuit board
	J31-0503-05	Beads × 26

PEN-RECORDER UNIT (X77-1050-00)

Ref.No	Parts No.	Description
R601,602	RN14BK2E2402F	24kΩ 1/4W ±1% Metal film res.
R603	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
R604	RN14BK2E1000G	100Ω 1/4W ±2% Metal film res.
R605	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R606	RN14BK2E2402F	24kΩ 1/4W ±1% Metal film res.
R607	RN14BK2E1202F	12kΩ 1/4W ±1% Metal film res.
R608	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
R609	RN14BK2E1000G	100Ω 1/4W ±2% Metal film res.
R610	RN14BK2E6801G	6.8kΩ 1/4W ±2% Metal film res.
R611	RN14BK2E5602F	56kΩ 1/4W ±1% Metal film res.
R612	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R613	RN14BK2E5101G	5.1kΩ 1/4W ±2% Metal film res.
R614	RN14BK2H5103G	510kΩ 1/2W ±2% Metal film res.
R615	RN14BK2E7500G	750Ω 1/4W ±2% Metal film res.
R617	RN14BK2E4701G	4.7kΩ 1/4W ±2% Metal film res.
R619	RN14BK2E1202G	12kΩ 1/4W ±2% Metal film res.
R620,621	RN14BK2E4700D	470Ω 1/4W ±0.5% Metal film res.
R622	RN14BK2E7501G	7.5kΩ 1/4W ±2% Metal film res.
R623,624	RN14BK2E8202G	82kΩ 1/4W ±2% Metal film res.
R625	RN14BK2E1603G	160kΩ 1/4W ±2% Metal film res.
R626	RN14BK2E2400G	240Ω 1/4W ±2% Metal film res.
R627	RN14BK2E3302G	33kΩ 1/4W ±2% Metal film res.
R628	RN14BK2E3601G	3.6kΩ 1/4W ±2% Metal film res.
R629	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
R630	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R631	RD14BB2E105J	1MΩ 1/4W ±5% Carbon res.
R632	RN14BK2E91ROF	91Ω 1/4W ±1% Metal film res.
R633	RN14BK2E1602F	16kΩ 1/4W ±1% Metal film res.
R634,635	RD14BB2E224J	220kΩ 1/4W ±5% Carbon res.
R636,637	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R638	RD14BB2E332J	3.3kΩ 1/4W ±5% Carbon res.
R639	RN14BK2E9101G	9.1kΩ 1/4W ±2% Metal film res.
R640	RN14BK2E1302G	13kΩ 1/4W ±2% Metal film res.
R641	RN14BK2E1201G	1.2kΩ 1/4W ±2% Metal film res.
R642	RN14BK2E9101G	9.2kΩ 1/4W ±2% Metal film res.
R643 ~ 646	RN14BK2E1003F	100kΩ 1/4W ±1% Metal film res.
R647	RN14BK2E1802G	18kΩ 1/4W ±2% Metal film res.
R648	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R649 ~ 651	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R652	RD14BB2E182J	1.8kΩ 1/4W ±5% Carbon res.
VR601,602	R12-3503-05	22kΩB Semi-fixed res.
VR603,604	R12-3039-05	10kΩB Semi-fixed res.
VR605	R12-0504-05	220ΩB Semi-fixed res.
VR606,607	R12-3039-05	10kΩB Semi-fixed res.
VR608	R12-0508-15	470ΩB Semi-fixed res.
TH601		Thermistor SDT-1000L
C601	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C602,603	CE04W1E101	100μF 25WV Electrolytic cap.
C604	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C605	CE04W1C330	33μF 16WV Electrolytic cap.
C606	CC45SL1H151J	150pF 50WV ±5% Ceramic cap.
C607	CC45CH1H020C	2pF 50WV ±0.25pF Ceramic cap.
C608	CS15E1V0R22	0.22μF 35WV Tontalum
C609	CC45SL1H101J	100pF 50WV ±5% Ceramic cap.
C610	CC45SL1H151J	150pF 50WV ±5% Ceramic cap.
C611	CQ93M1H104J	0.1μF 50WV ±5% Polyester cap.
C612	CQ93M1H103J	0.01μF 50WV ±5% Polyester cap.
C613	CQ93M1H104J	0.1μF 50WV ±5% Polyester cap.
C614	CQ93M1H103J	0.01μF 50WV ±5% Polyester cap.
IC601,602		IC CA301AG
1C603		IC CA741CG
IC604		IC HA1127
IC605		IC CA741CG
IC606 ~ 608		IC NJM4558D
Q601,602		Transistor 2SC945 (Q)
D601 ~ 602		Diode 1S1555
TP601 ~ 603	E23-0512-05	1P Pin-connector
CN601	E40-0303-05	3P Pin-connector
CN602 ~ 604	E40-0364-05	3P Pin-connector
CN605	E40-1113-05	11P Pin-connector
CN606	E40-0464-05	4P Pin-connector
CN607 ~ 609	E40-0364-05	3P Pin-connector
CN610	E23-0512-05	1P Pin-connector
	J25-2843-03	Printed circuit board
	J31-0503-05	Beads × 28
RL601	S51-1020-05	Relay

SIGNAL GENERATOR UNIT (X71-1020-00)

Ref.No	Parts No.	Description
R301	RN14BK2E4301G	4.3kΩ 1/4W ±2% Metal film res.
R302	RN14BK2E3901F	3.9k7 1/4W ±1% Metal film res.
R303 ~ 305	RN14BK2E4701F	4.7kΩ 1/4W ±1% Metal film res.
R306	RN14BK2E4501F	4.5kΩ 1/4W ±1% Metal film res.
R307,308	RN14BK2E8451D	8.45kΩ 1/4W ±0.5% Metal film res.
R309	RD14BB2E470J	47Ω 1/4W ±5% Carbon res.
R310	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R311	RD14BB2E272J	2.7kΩ 1/4W ±5% Carbon res.
R312	RD14BB2E102J	1kΩ 1/4W ±5% Carbon res.

PARTS LIST

Ref.No	Parts No.	Description
R313,314	RN14BK2E1001G	1kΩ 1/4W ±2% Metal film res.
R315	RD14BB2E822J	8.2kΩ 1/4W ±5% Carbon res.
R316	RD14BB2E123J	12kΩ 1/4W ±5% Carbon res.
R317	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R318	RN14BK2E4701G	470Ω 1/4W ±2% Metal film res.
R319,320	RN14BK2E1202G	12kΩ 1/4W ±2% Metal film res.
R321,322	RD14BB2E272J	2.7kΩ 1/4W ±5% Carbon res.
R323	RD14BB2E102J	1kΩ 1/4W ±5% Carbon res.
R324	RN14BK2E49R9F	49.9Ω 1/4W ±1% Metal film res.
R325,326	RN14BK2E1132F	11.3kΩ 1/4W ±1% Metal film res.
R327	RN14BK2E3090F	309Ω 1/4W ±1% Metal film res.
R328,329	RN14BK2E1212F	12.1kΩ 1/4W ±1% Metal film res.
R330	RN14BK2E2000F	200Ω 1/4W ±1% Metal film res.
R331,332	RN14BK2E2492F	24.9kΩ 1/4W ±1% Metal film res.
R333	RN14BK2E1270F	127Ω 1/4W ±1% Metal film res.
R334	RN14BK2E63R4F	63.4Ω 1/4W ±1% Metal film res.
R335	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R336	RD14BB2E104J	100kΩ 1/4W ±5% Carbon res.
R338	RN14BK2H5103G	510kΩ 1/2W ±2% Carbon res.
R339	RN14BK2E4701G	4.7kΩ 1/4W ±2% Metal film res.
R340,341	RD14BB2E472J	4.7kΩ 1/4W ±5% Carbon res.
R342,343	RD14BB2E4R7J	4.7Ω 1/4W ±5% Carbon res.
R344	RN14BK2E5760F	576Ω 1/4W ±1% Metal film res.
R345	RN14BK2E6001G	6kΩ 1/4W ±2% Metal film res.
R346	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R347	RN14BK2E6650F	665Ω 1/4W ±1% Metal film res.
R348	RN14BK2E1000G	100Ω 1/4W ±2% Metal film res.
R349	RN14BK2E2702G	27kΩ 1/4W ±2% Metal film res.
R350	RN14BK2E6192F	61.9kΩ 1/4W ±1% Metal film res.
R351	RN14BK2E2002F	20kΩ 1/4W ±1% Metal film res.
R352	RN14BK2E1132F	11.3kΩ 1/4W ±1% Metal film res.
R353~359	RN14BK2E1621F	1.62kΩ 1/4W ±1% Metal film res.
R360	RN14BK2E1601F	1.6kΩ 1/4W ±1% Metal film res.
R361	RN14BK2E2671F	2.67kΩ 1/4W ±1% Metal film res.
R362	RN14BK2E7322F	73.2kΩ 1/4W ±1% Metal film res.
R363	RN14BK2E1241F	1.24kΩ 1/4W ±1% Metal film res.
R364	RN14BK2E2002F	20kΩ 1/4W ±1% Metal film res.
R365	RN14BK2E4002F	40kΩ 1/4W ±1% Metal film res.
R366	RN14BK2E2002F	20kΩ 1/4W ±1% Metal film res.
R367	RN14BK2E1002F	10kΩ 1/4W ±1% Metal film res.
R368	RN14BK2E5001F	5kΩ 1/4W ±1% Metal film res.
R369	RN14BK2E2491F	2.49kΩ 1/4W ±1% Metal film res.
R370	RN14BK2E1241F	1.24kΩ 1/4W ±1% Metal film res.
R371	RN14BK2E6430F	643Ω 1/4W ±1% Metal film res.
R372	RN14BK2E3090F	309Ω 1/4W ±1% Metal film res.
R373	RN14BK2E3160F	316Ω 1/4W ±1% Metal film res.
VR301	R12-1030-05	1kΩB Semi-fixed res.
VR302	R12-0508-05	470ΩB Semi-fixed res.
VR303,304	R12-3501-05	10kΩB Semi-fixed res.
VR305,306	R12-1031-05	2.2kΩB Semi-fixed res.
VR307	R12-3039-05	10kΩB Semi-fixed res.
C301	CQ09S1H622J	6200pF 50WV ±5% Polystyrene film cap
C302	CC45CH1H470J	47pF 50WV ±5% Ceramic cap.
C303	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C304	CE04W1C101	100μF 16WV Electrolytic cap.
C305	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C306	CE04W1E101	100μF 25WV Electrolytic cap.
C307	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C308	CE04W1E101	100μF 25WV Electrolytic cap.
C309	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C310	CE04W1C101	100μF 16WV Electrolytic cap.
C311	CQ93M1H104K	0.1μF 50WV ±10% Polyester film cap.
C312	CC45CH1H101J	100pF 50WV ±5% Ceramic cap.

Ref.No	Parts No.	Description
IC301		IC NJM4558D
IC302,303		IC CA741CG
IC304		IC CA3100T
Q301,30		Transistor 2SC945 (Q)
Q303~306		Transistor 2SA733 (Q)
Q307,308		Transistor 2SC945 (Q)
Q309		FET 2SK30A (GR)
Q310~313		Transistor 2SC945 (Q)
Q314,315		Transistor 2SA733 (Q)
Q316		Transistor 2SC1212A (C)
Q317		Transistor 2SA743A (C)
Q318		FET 2SK30A (GR)
D301~332		Diode 1S1587
D333		Diode 1S1555
D335,336		Diode 1S1555
TP301~304	E23-0512-05	1P Pin-connector
CN301	E40-0303-05	3P Pin-connector
CN302	E40-0364-05	3P Pin-connector
CN303	E23-0512-05	1P Pin-connector
CN304~307	E40-0364-05	3P Pin-connector
CN308	E40-0464-05	4P Pin-connector
	F02-0004-05	Heat sink
	J25-2838-03	Printed circuit board
	J31-0503-05	Beads × 22

SWEEP UNIT (74-1140-00)

Ref.No	Parts No.	Description
R401	RN14BK2E2202G	22kΩ 1/4W ±2% Metal film res.
R402	RN14BK2E1502G	15kΩ 1/4W ±2% Metal film res.
R403	RN14BK2E1300G	130Ω 1/4W ±2% Metal film res.
R404	RN14BK2E2702G	27kΩ 1/4W ±2% Metal film res.
R405	RN14BK2E1003F	100kΩ 1/4W ±1% Metal film res.
R406	RN14BK2H1004F	1MΩ 1/2W ±1% Metal film res.
R407	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
R408	RN14BK2E5601F	5.6kΩ 1/4W ±1% Metal film res.
R409	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R410	RN14BK2E6800G	680Ω 1/4W ±2% Metal film res.
R411	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
R412	RN14BK2E3003G	300kΩ 1/4W ±2% Metal film res.
R413	RN14BK2E1503G	150kΩ 1/4W ±2% Metal film res.
R414	RN14BK2E7502G	75kΩ 1/4W ±2% Metal film res.
R415	RN14BK2E3901G	3.9kΩ 1/4W ±2% Metal film res.
R416	RN14BK2H3303G	330kΩ 1/2W ±2% Metal film res.
R417	RN14BK2E2002F	20kΩ 1/4W ±1% Metal film res.
R418	RN14BK2E1002F	10kΩ 1/4W ±1% Metal film res.
R419	RN14BK2E3002F	30kΩ 1/4W ±1% Metal film res.
R420,421	RN14BK2E1002F	10kΩ 1/4W ±1% Metal film res.
R422	RN14BK2E3001F	3kΩ 1/4W ±1% Metal film res.
R423	RN14BK2E1202G	12kΩ 1/4W ±2% Metal film res.
R424	RN14BK2E4701G	4.7kΩ 1/4W ±2% Metal film res.
R425	RN14BK2E3302G	33kΩ 1/4W ±2% Metal film res.
R426	RN14BK2E36R0G	36Ω 1/4W ±2% Metal film res.
R427	RN14BK2H1004G	1MΩ 1/2W ±2% Metal film res.

PARTS LIST

Ref.No	Parts No.	Description
R428	RN14BK2E6800G	680Ω 1/4W ±2% Metal film res.
R429	RN14BK2E8200G	820Ω 1/4W ±2% Metal film res.
R430	RN14BK2E1373F	137kΩ 1/4W ±1% Metal film res.
R431	RN14BK2E1003G	100kΩ 1/4W ±2% Metal film res.
VR401	R12-1031-05	2.2kΩB Semi-fixed res.
VR402,403	R12-1030-05	1kΩB Semi-fixed res.
VR404	R12-3503-05	22kΩB Semi-fixed res.
VR405	R12-1030-05	1kΩB Semi-fixed res.
VR406	R12-3503-05	22kΩB Semi-fixed res.
VR407,408	R12-3039-05	10kΩB Semi-fixed res.
TH401		Thermistor SDT-1000L
C401	C91-0519-05	1μF 100WV Metalized Polyester cap.
C402	CQ93M1H104J	0.1μF 50WV ±5% Polyester cap.
C403	CC45SL1H221J	220pF 50WV ±5% Ceramic cap.
C404	CE04W1E101	100μF 25WV Electrolytic
C405	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C406	CE04W1E101	100μF 25WV Electrolytic cap.
C407	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C408	CK45D1H102K	1000pF 50WV ±10% Ceramic cap.
IC401		IC CA3140E
IC402,403		IC NJM4558D
IC404,405		IC CA741CG
IC406		IC MC14066BCP
IC407		IC NJM4558D
IC408		IC HA1127
IC409		IC MC14066BCP
TP401 ~ 404	E23-0512-05	1P Pin-connector
CN401	E40-0303-05	3P Pin-connector
CN402	E23-0512-05	1P Pin-connector
CN403,404	E40-0364-05	3P Pin-connector
CN405	E40-0464-05	4P Pin-connector
CN407,408	E23-0512-05	1P Pin-connector
	J25-2840-03	Printed circuit board
	J31-0503-05	Beads ×10

REVERBERATION INDICATOR UNIT (79-1000-00)

Ref.No	Parts No.	Description
R101	RN14BK2E7500G	750Ω 1/4W ±2% Metal film res.
R102	RN14BK2E1302G	13kΩ 1/4W ±2% Metal film res.
R103,104	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R106	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R107	RN14BK2H1004F	1MΩ 1/2W ±1% Metal film res.
R108	RN14BK2H1004G	1MΩ 1/2W ±2% Metal film res.
R109	RD14BB2E562J	5.6kΩ 1/4W ±5% Carbon res.
R110	RD14BB2E105J	1MΩ 1/4W ±5% Carbon res.
R111	RN14BK2E2001G	2kΩ 1/4W ±2% Metal film res.
R114	RN14BK2E8200G	820Ω 1/4W ±2% Metal film res.
R115,116	RN14BK2E2401D	2.4kΩ 1/4W ±0.5% Metal film res.
R117,118	RD14BB2E222J	2.2kΩ 1/4W ±5% Carbon res.
R119	RN14BK2E1002F	10kΩ 1/4W ±1% Metal film res.
R120	RN14BK2E1501F	1.5kΩ 1/4W ±1% Metal film res.
VR101	R12-0508-05	470ΩB Semi-fixed res.
VR102	R12-1031-05	2.2kΩB Semi-fixed res.
VR103	R12-1030-05	1kΩB Semi-fixed res.

Ref.No	Parts No.	Description
C101	C91-0522-05	0.33μF 100WV Polypropylen cap.
C102	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C103	CE04W1E101	100μF 25WV Electrolytic cap.
C104	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C105	CE04W1E101	100μF 25WV Electrolytic cap.
C106	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
IC101*		IC CA3140E
IC102		IC NJM4558D
IC103		IC MC14066BCP
IC104		IC NJM4558D
D101		Diode 1S1555
D102,103		Zener diode WZ-081
D104		Diode 1S1555
TP101,102	E23-0512-05	1P Pin-connector
CN101	E40-0303-05	3P Pin-connector
CN102 ~ 106	E40-0364-05	3P Pin-connector
	J25-2841-03	Printed circuit board

MODE SELECTOR UNIT (X84-1020-00)

Ref.No	Parts No.	Description
CN201	E40-1513-05	15P Pin-connector
CN202	E40-0464-05	4P Pin-connector
CN203 ~ 205	E40-0364-05	3P Pin-connector
	J25-2839-03	Printed circuit board
	J31-0503-05	Beads ×8

METER PROTECTION UNIT (X84-1030-00)

Ref.No	Parts No.	Description
R901	RD14BB2E104J	100kΩ 1/4W ±5% Carbon res.
R902	RD14BB2E821J	820Ω 1/4W ±5% Carbon res.
C901	CS14E1EOR47M	0.47μF 25WV ±20% Tantalum cap.
R902	CS15E1VOR33M	0.33μF 35WV ±20% Tantalum cap.
C903	CE04W1C102	1000μF 16WV Electrolytic cap.
Q901		Transistor 2SC945 (Q)
D901,902		Diode 1S1555
	E23-0512-05	1P Pin-connector
	J25-2858-04	Printed circuit board
RL901	S51-1020-05	Relay

CONTROL UNIT (X77-1040-01)

Ref.No	Parts No.	Description
R701	RN14BK2E3000G	330Ω 1/4W ±2% Metal film res.
R702	RN14BK2E1801G	1.8kΩ 1/4W ±2% Metal film res.
R703	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.

PARTS LIST

Ref.No	Parts No.	Description
R704	RD14BB2E332J	3.3Ω 1/4W ±5% Carbon res.
R705~707	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R708	RD14BB2E331J	330Ω 1/4W ±5% Carbon res.
R709	RN14BK2E8201G	8.2kΩ 1/4W ±2% Metal film res.
R710	RD14BB2E393J	39kΩ 1/4W ±5% Carbon res.
R711	RD14BB2E183J	18kΩ 1/4W ±5% Carbon res.
R713	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R714	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R715	RD14BB2E332J	3.3kΩ 1/4W ±5% Carbon res.
R716	RD14BB2E682J	6.8Ω 1/4W ±5% Carbon res.
R717,718	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R719	RD14BB2E822J	8.2kΩ 1/4W ±5% Carbon res.
R720	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R721	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R722	RD14BB2E821J	820Ω 1/4W ±5% Carbon res.
R723	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R724,725	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R726	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R727	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R729	RD14BB2E153J	15kΩ 1/4W ±5% Carbon res.
R730~732	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R734,735	RD14BB2E681J	680Ω 1/4W ±5% Carbon res.
R736~738	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R739	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R741	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R743	RD14BB2E331J	330Ω 1/4W ±5% Carbon res.
R744,745	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R746	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R747	RD14BB2E332J	3.3Ω 1/4W ±5% Carbon res.
R748	RD14BB2E682J	6.8Ω 1/4W ±5% Carbon res.
R749,750	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R751	RD14BB2E822J	8.2kΩ 1/4W ±5% Carbon res.
R752,753	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R754	RN14BK2E2001F	2kΩ 1/4W ±1% Metal film res.
R755	RD14BB2E472J	4.7kΩ 1/4W ±5% Carbon res.
R756	RD14BB2E222J	2.2kΩ 1/4W ±5% Carbon res.
R757~761	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R762	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R763	RD14BB2E821J	820Ω 1/4W ±5% Carbon res.
R764	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R765	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R766	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R767	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R768	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R769	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R770	RD14BB2E681J	680Ω 1/4W ±5% Carbon res.
R771	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R772	RD14BB2E333J	33kΩ 1/4W ±5% Carbon res.
R773	RD14BB2E332J	3.3kΩ 1/4W ±5% Carbon res.
R774	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R775	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R776	RD14BB2E822J	8.2kΩ 1/4W ±5% Carbon res.
R777,778	RD14BB2E102J	1kΩ 1/4W ±5% Carbon res.
R779	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R780	RD14BB2E222J	2.2kΩ 1/4W ±5% Carbon res.
R781,782	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R783~785	RD14BB2E682J	6.8kΩ 1/4W ±5% Carbon res.
R786	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R787	RD14BB2E153J	15kΩ 1/4W ±5% Carbon res.
R788	RD14BB2E103J	10kΩ 1/4W ±5% Carbon res.
R789,790	RD14BB2E153J	15kΩ 1/4W ±5% Carbon res.
VR701,702	R12-1030-05	1kΩB Semi-fixed res.
C701	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C702	CQ93M1H104J	0.1μF 50WV ±5% Polyester cap.
C703	CK45B1H102K	1000pF 50WV ±10% Ceramic cap.
C704	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C705	CE04W1A330	33μF 10WV Electrolytic cap.
C706	CE04W1A471	470μF 10WV Electrolytic cap.
C707	CE04W1A330	33μF 10WV Electrolytic cap.
C708	CK45B1H102K	1000pF 50WV ±10% Ceramic cap.
C709	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C710	CQ93M1H104K	0.1μF 50WV ±10% Polyester cap.
C713,714	CE04W1E100	10μF 25WV Electrolytic cap.
C716	CE04W1A101	100μF 10WV Electrolytic cap.
C717	CE04W1A100	10μF 10WV Electrolytic cap.
C718,719	CE04W1A470	47μF 10WV Electrolytic cap.
C721~730	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
IC701		IC RC555DN
IC702		IC CD4020AE
IC703		IC SN74LS00N
IC704		IC SN74LS90N
IC705		IC SN74LS125N
IC706		IC RC555DN
IC707		IC SN74LS90N
IC708		IC RC555DN
IC709		IC SN74LS90N
IC710		IC SN74LS125N
IC711,712		IC SN74LS74N
IC713		IC SN74LS00N
IC714		IC SN74LS123N
IC715		IC SN74LS00N
IC716		IC SN74LS125N
IC717		IC SN74LS74N
IC718		IC SN74LS00N
IC719		IC SN74LS90N
IC720		IC SN74LS74N
IC721		IC SN74LS08N
IC722		IC SN74LS125N
Q701		Transistor 2SC945 (Q)
Q702		Transistor 2SA733 (Q)
Q703		Transistor 2SC945 (Q)
Q704		Transistor 2SA733 (Q)
Q705~707		Transistor 2SC945 (Q)
Q708		Transistor 2SC1973
Q709		Transistor 2SC945 (Q)
Q710		Transistor 2SC1973
Q711		Transistor 2SA733 (Q)
Q712~715		Transistor 2SC945 (Q)
Q716		Transistor 2SA733 (Q)
Q717~719		Transistor 2SC945 (Q)
Q720		Transistor 2SC1973
Q721		Transistor 2SA733 (Q)
Q722~725		Transistor 2SC945 (Q)
D701~709		Diode 1S1555
D710,711		Diode 1N60

PARTS LIST

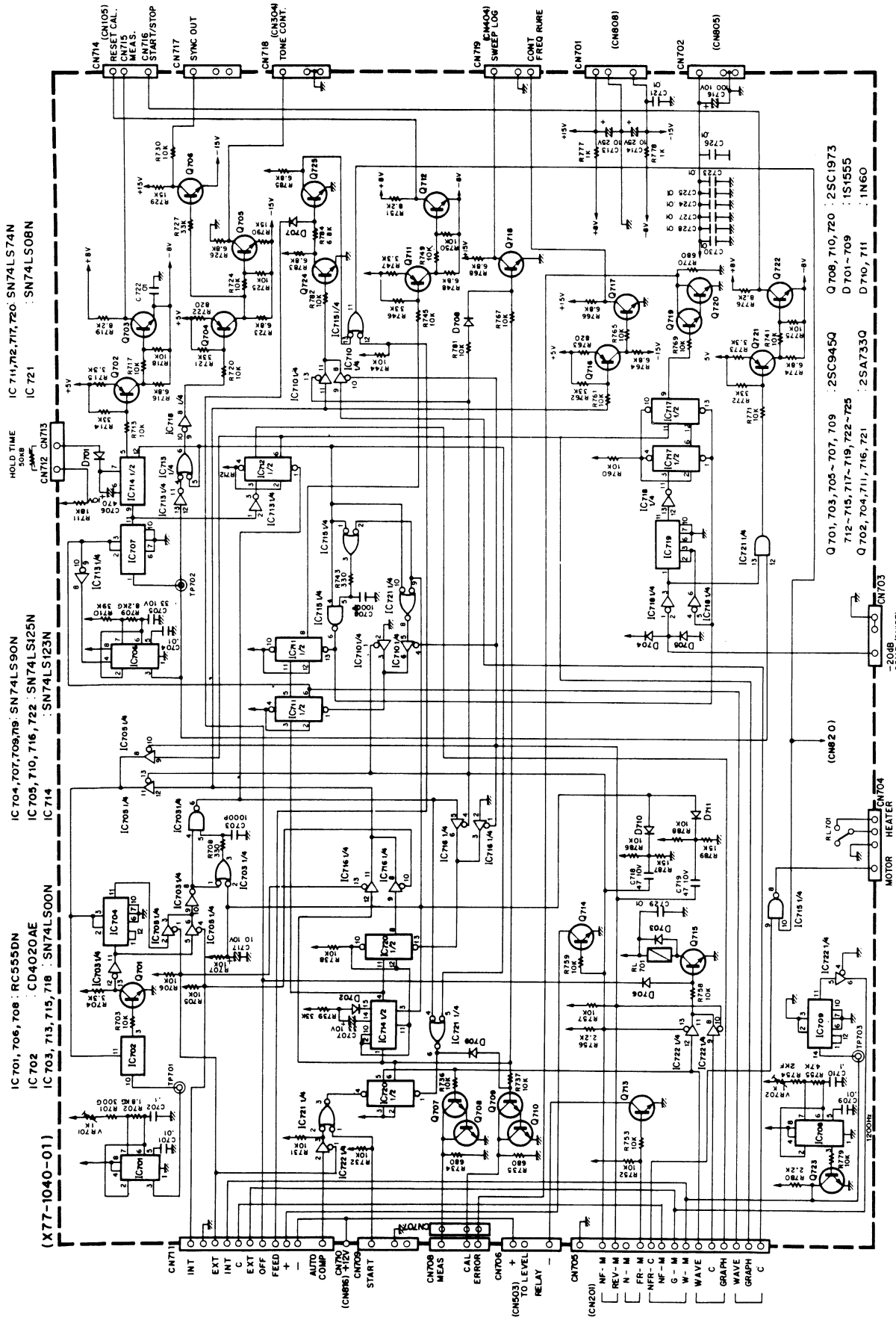
Ref.No	Parts No.	Description
TP701 ~ 703	E23-0512-05	1P Pin-connector
	E23-0515-05	Earth plate
CN701,702	E40-0303-05	3P Pin-connector
CN703	E40-0364-05	3P Pin-connector
CN704	E40-0464-05	4P Pin-connector
CN705	E40-1513-05	15P Pin-connector
CN706 ~ 709	E40-0364-05	3P Pin-connector
CN710	E23-0512-05	1P Pin-connector
CN711	E40-1113-05	11P Pin-connector
CN712 ~ 717	E23-0512-05	1P Pin-connector
CN718,719	E40-0364-05	3P Pin-connector
	J25-2844-03	Printed circuit board
	J31-0503-05	Beads ×50
RL701	S51-1511-05	Relay

POWER SUPPLY UNIT (X68-1220-00)

Ref.No	Parts No.	Description
R801	RN14BK2E3602F	36kΩ 1/4W ±1% Metal film res.
R802,803	RN14BK2E3001G	3kΩ 1/4W ±2% Metal film res.
R804	RN14BK2E2001G	2kΩ 1/4W ±2% Metal film res.
R806	RD14BB2E101J	100Ω 1/4W ±5% Carbon res.
R807,808	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R809	RN14BK2E3600F	360Ω 1/4W ±1% Metal film res.
R810	RN14BK2E6201F	6.2kΩ 1/4W ±1% Metal film res.
R811	RN14BK2E1102F	11kΩ 1/4W ±1% Metal film res.
R812,813	RN14BK2E1002G	10kΩ 1/4W ±2% Metal film res.
R814	RD14BB2E391J	390Ω 1/4W ±5% Carbon res.
R815	RS14AB3A102J	1kΩ 1W ±5% Metal oxide film res.
R816	RN14BK2E1501F	1.5kΩ 1/4W ±1% Metal film res.
VR801,802	R12-1029-05	1kΩB Semix-fixed res.
C801,802	CE04W1C102	1000μF 16WV Electrolytic cap.
C803	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C804	CE04W1V102	1000μF 35WV Electrolytic cap.
C805	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C806	CE04W1V102	1000μF 35WV Electrolytic cap.
C807	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C808	CE04W1K101	100μF 80WV Electrolytic cap.
C809 ~ 811	CE04W1E332	3300μF 25WV Electrolytic cap.
C812	CE04W1E101	100μF 25WV Electrolytic cap.
C813	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C814	CC45SL1H101J	100pF 50WV ±5% Ceramic cap.
C815	CE04W1J470	47μF 63WV Electrolytic cap.
C816	CE04W1E101	100μF 25WV Electrolytic cap.
C817	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C818	CE04W1C101	100μF 16WV Electrolytic cap.
C819	CK45B1H103K	0.01μF 50WV ±10% Ceramic cap.
C820	CE04W1C101	100μF 16WV Electrolytic cap.
C821	CK45B1H103K	0.01μF 50WV ±10% Electrolytic cap.
IC801		IC μA7805C
IC802		IC μA7815C
IC803,804		IC NJM4558D
IC805		IC RC723T
IC806		IC SN74LS08N
Q801		Transistor 2SB633E
Q802		Transistor 2SA733 (Q)
D801		Zener diode WZ-120
D802		Zener diode WZ-061
D803		Diode 1N823
D804 ~ 806		Diode W04M
D807		Diode S1QB40
D808,809		Diode S2VB40F
D810,811		Zener diode WZ-240
CN801	E40-0432-05	4P Pin-connector
CN802,803	E40-0532-05	5P Pin-connector
CN805	E40-0303-05	3P Pin-connector
CN806	E23-0512-05	1P Pin-connector
CN807 ~ 811	E40-0303-05	3P Pin-connector
CN812	E40-0364-05	3P Pin-connector
CN813	E23-0512-05	1P Pin-connector
CN814	E40-0364-05	3P Pin-connector
CN815	E40-0403-05	4P Pin-connector
CN816	E23-0512-05	1P Pin-connector
CN817	E40-0403-05	4P Pin-connector
CN818,819	E40-0364-05	3P Pin-connector
CN820	E23-0512-05	1P Pin-connector

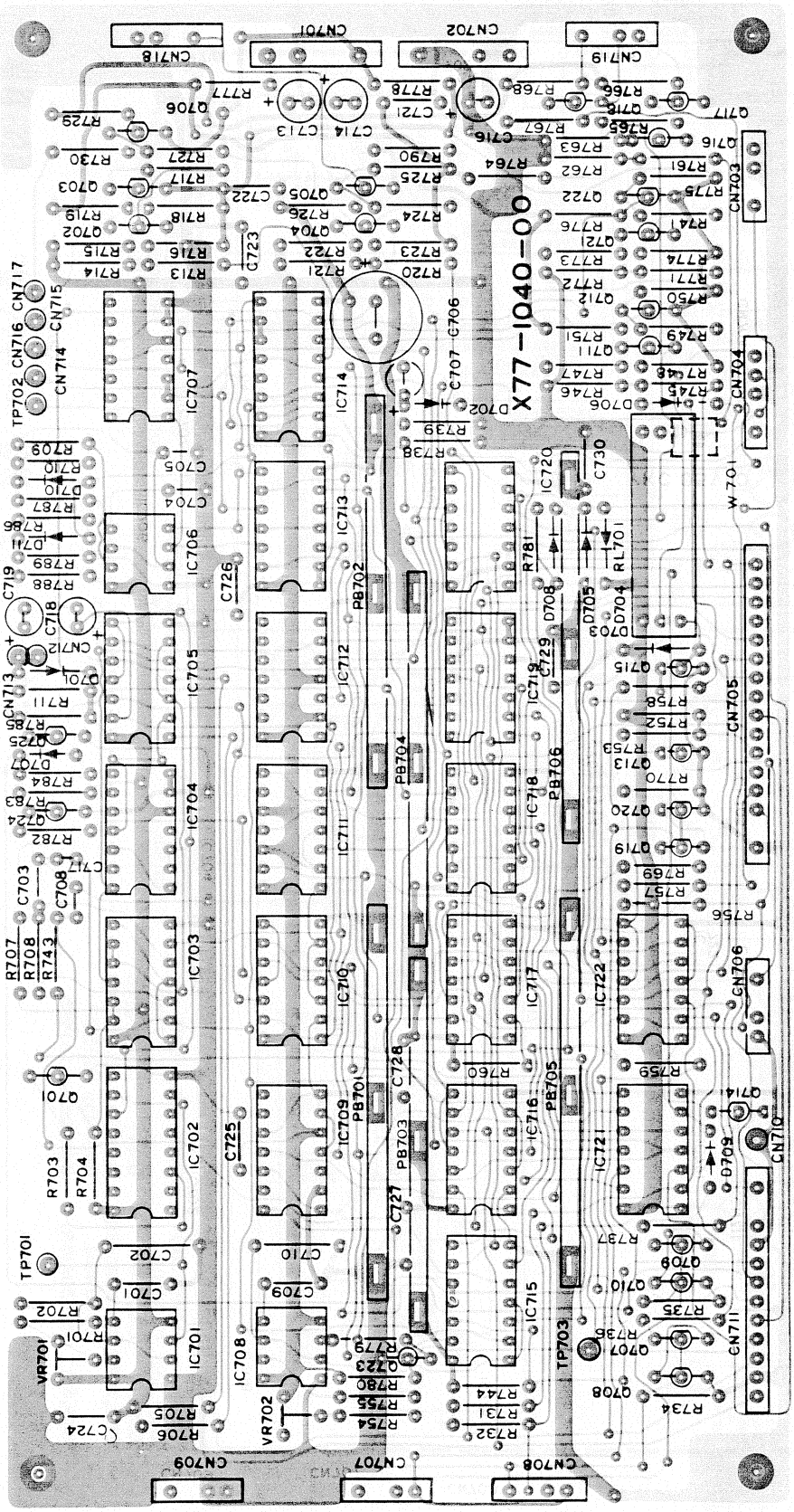
SCHEMATIC DIAGRAM

CONTROL UNIT (X77-1040-01)



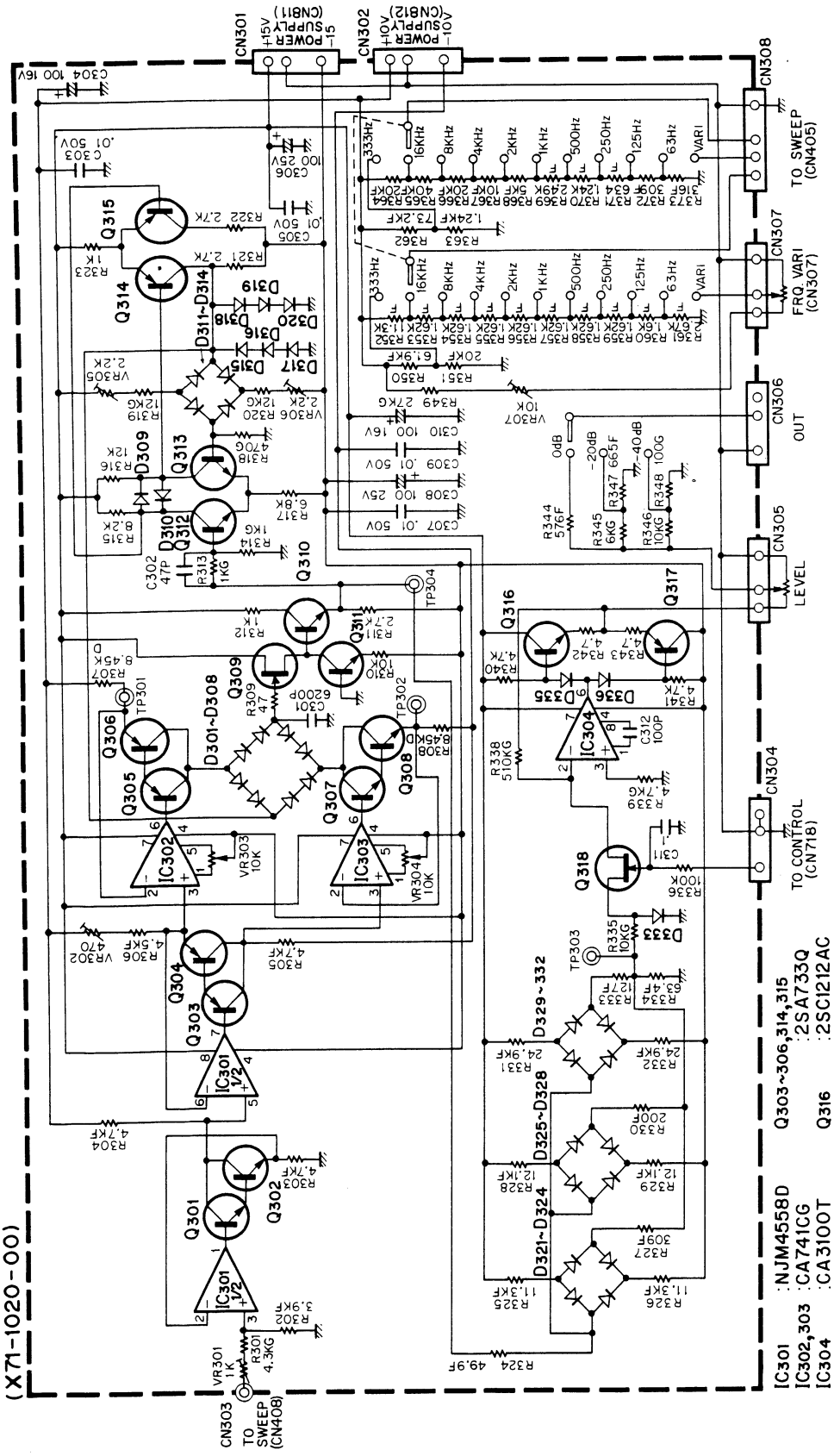
P.C. BOARD

CONTROL UNIT (X77-1040-01)

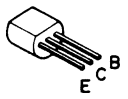


SCHEMATIC DIAGRAM

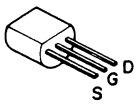
SIGNAL GENERATOR UNIT (X71-1020-00)



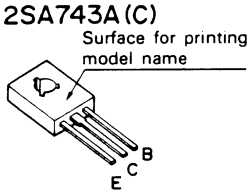
2SC945(Q)
2SA733(Q)



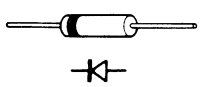
2SK30A(O)



2SC1212A(C)
2SA743A(C)

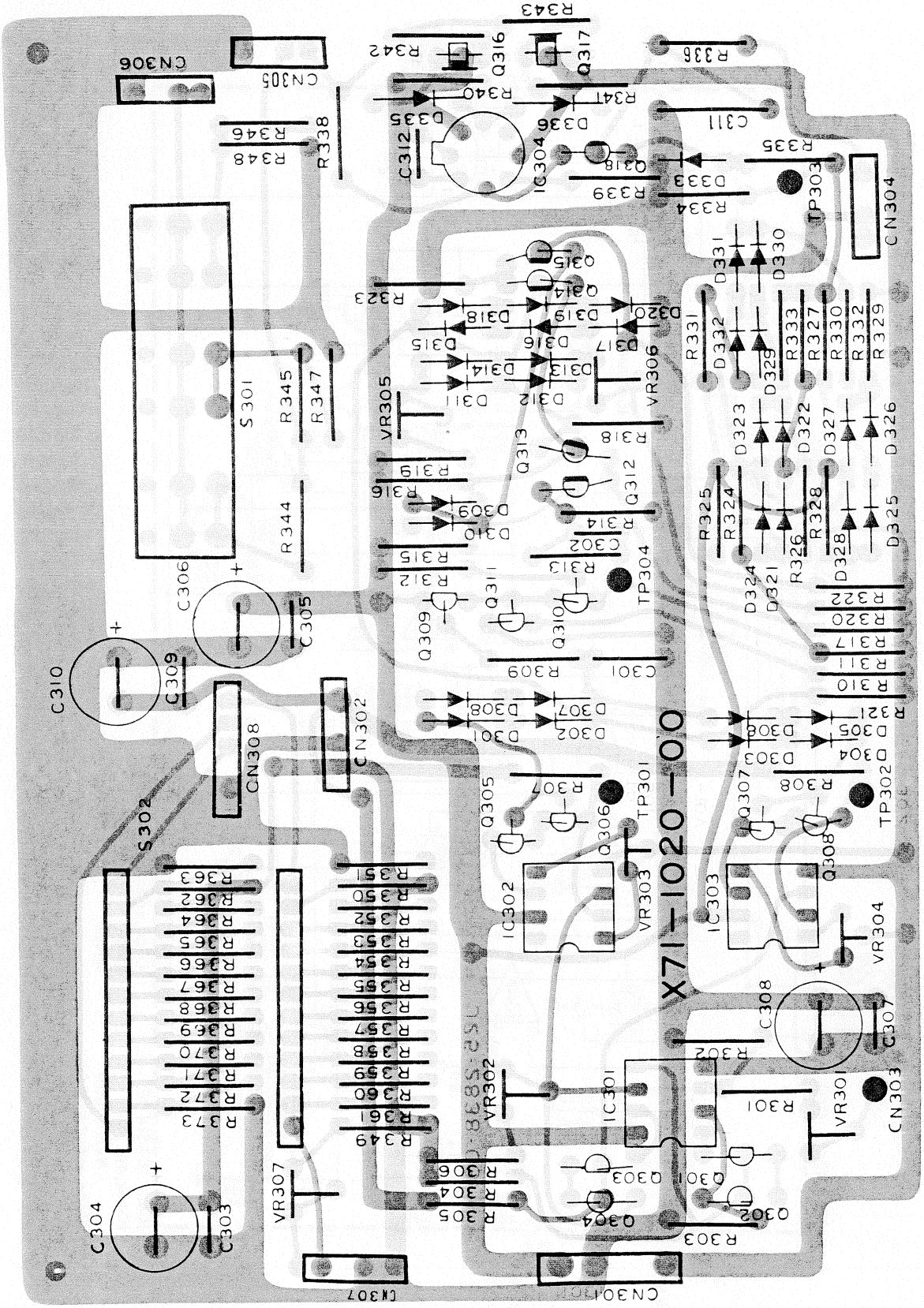


1S1587
1S1555



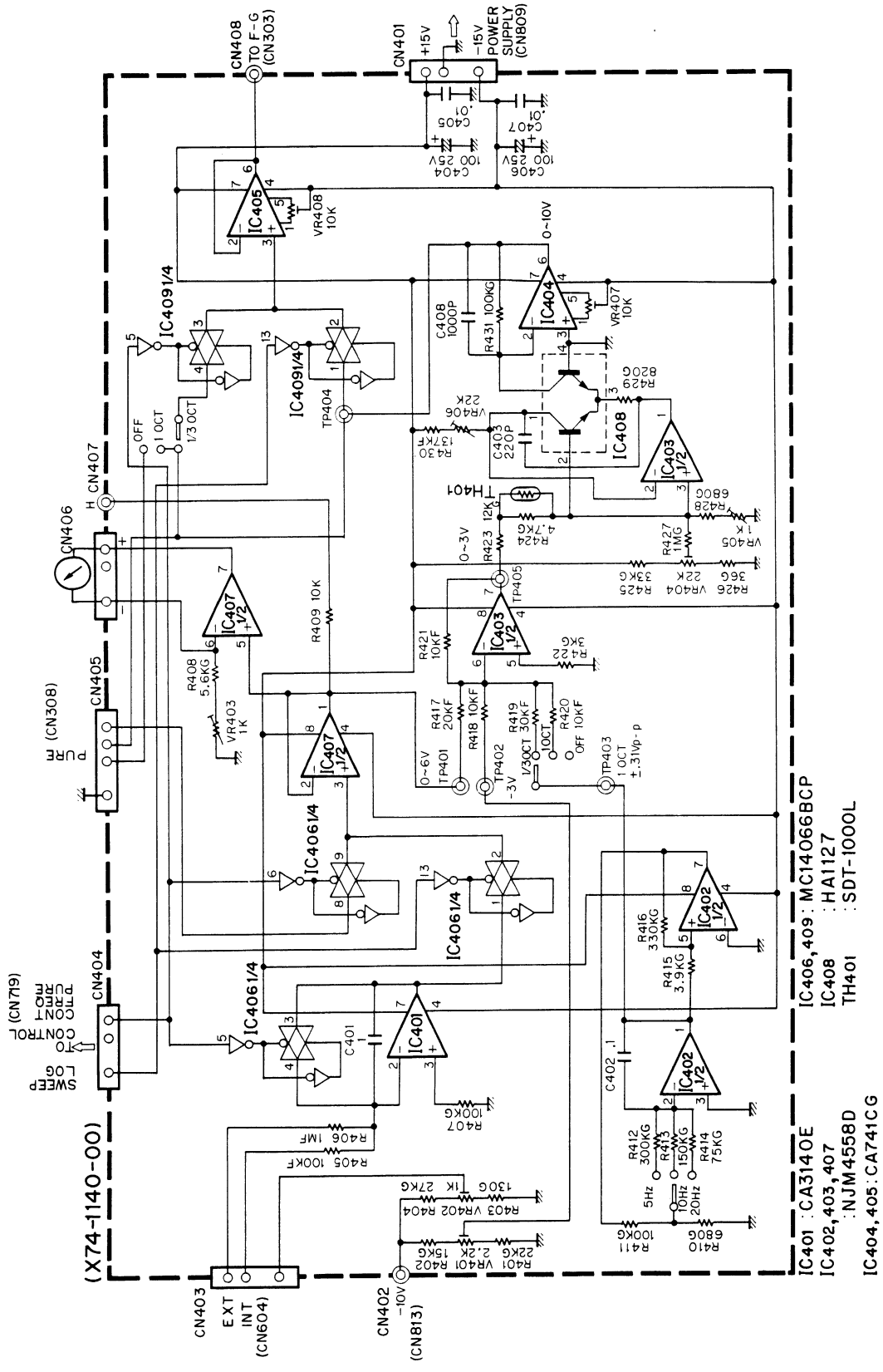
P.C. BOARD

SIGNAL GENERATOR UNIT (X71-1020-00)



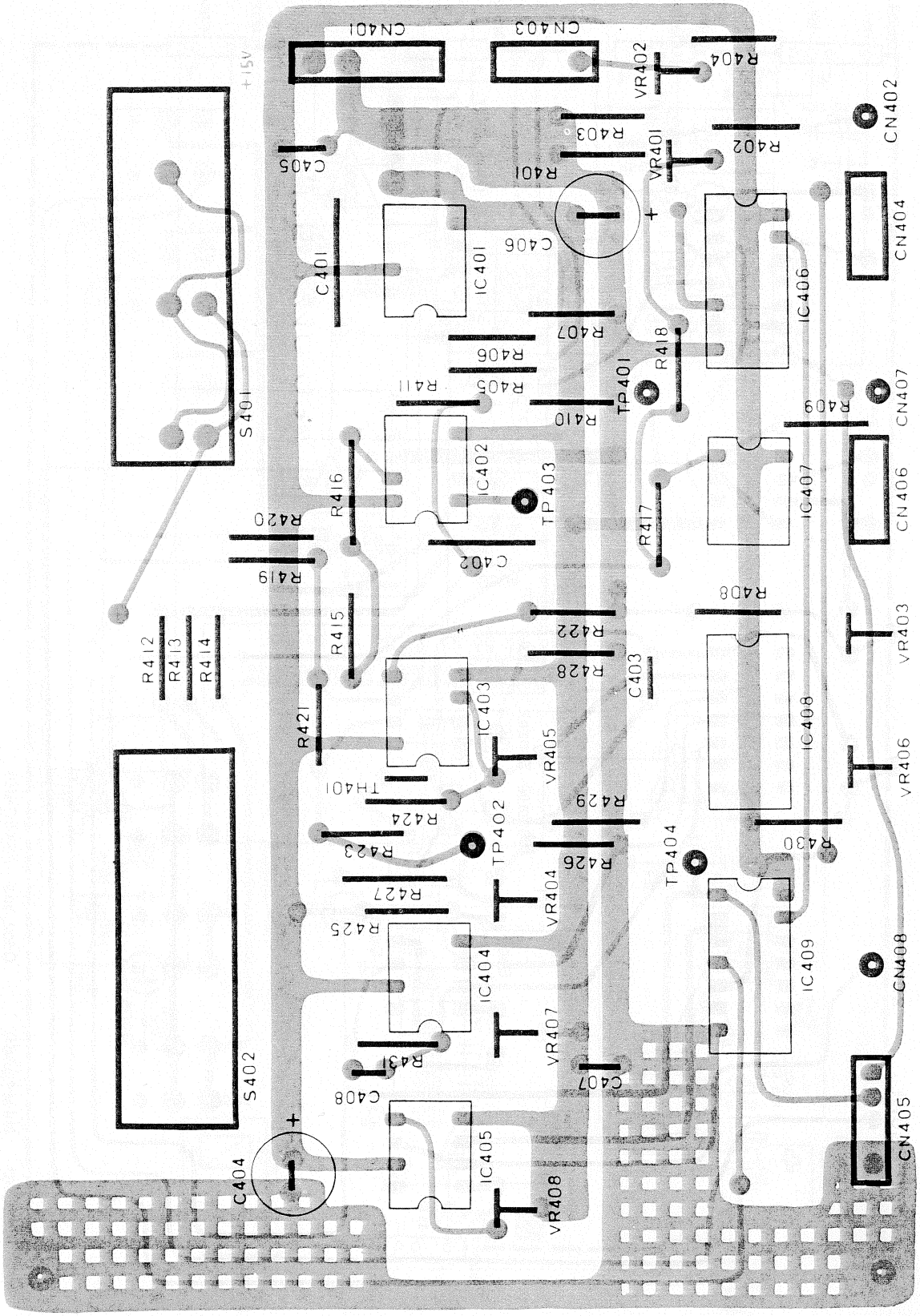
SCHEMATIC DIAGRAM

SWEEP UNIT (X74-1140-00)



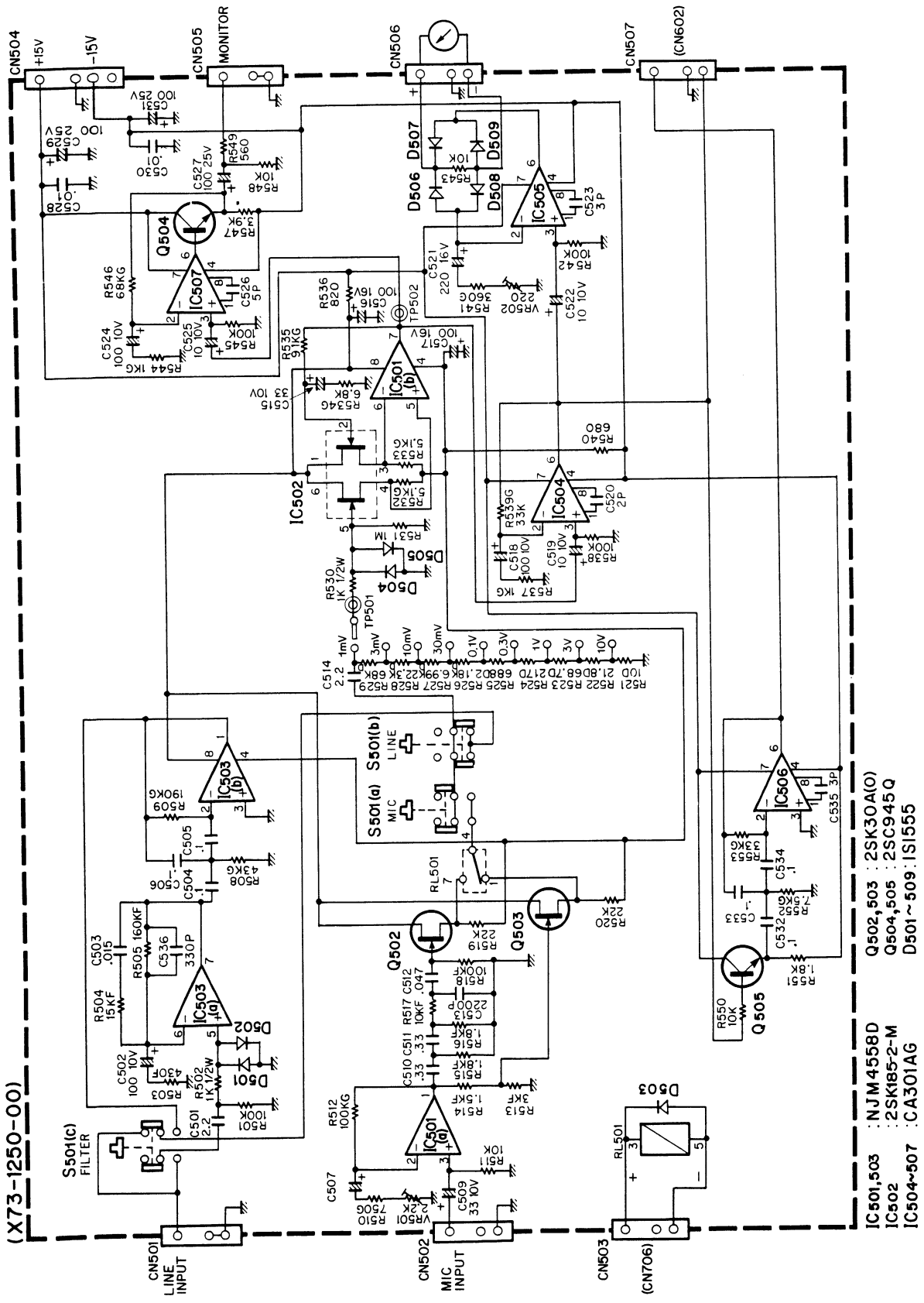
P.C. BOARD

SWEEP UNIT (X74-1140-00)



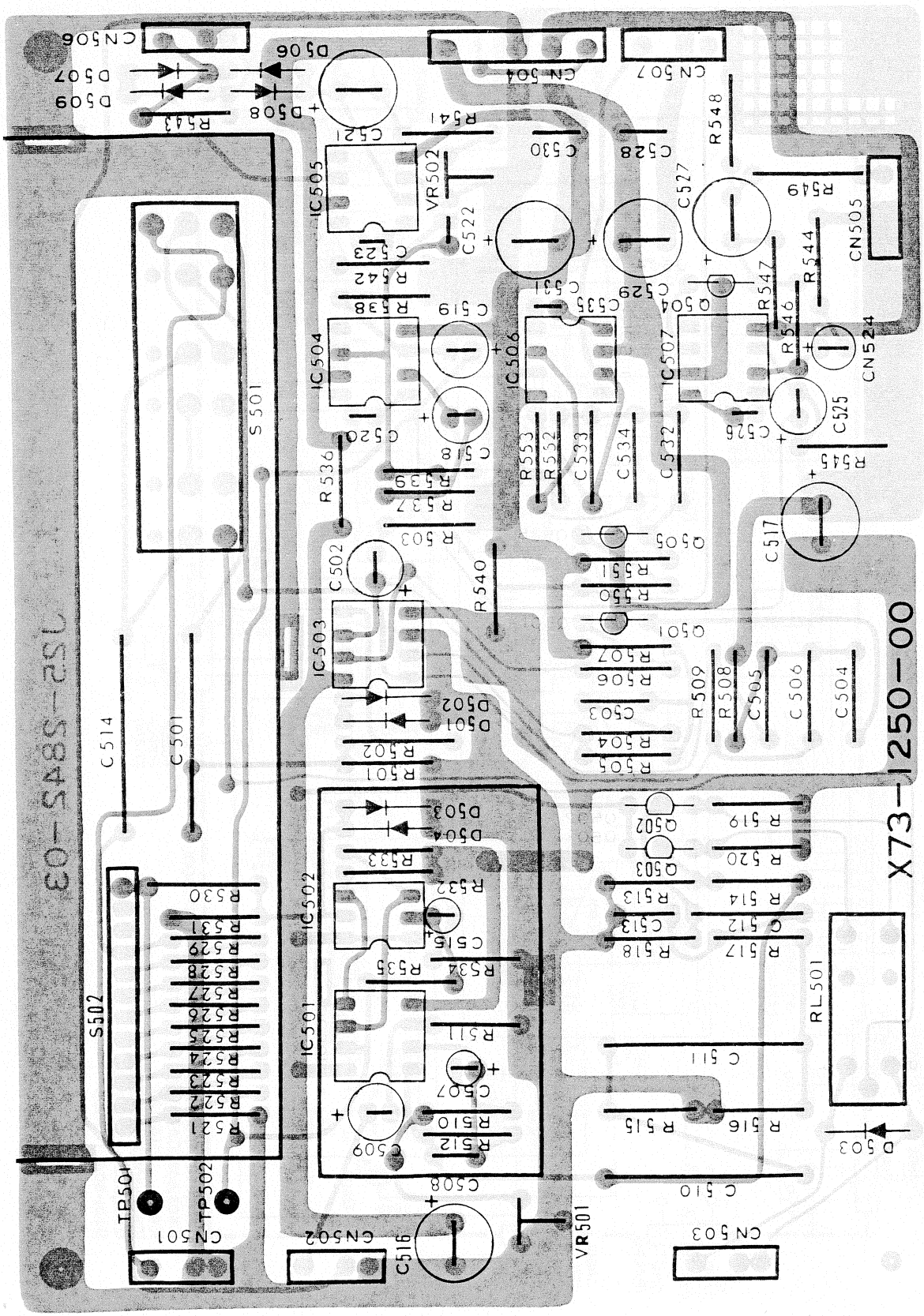
SCHEMATIC DIAGRAM

LEVEL INDICATOR UNIT (X73-1250-00)



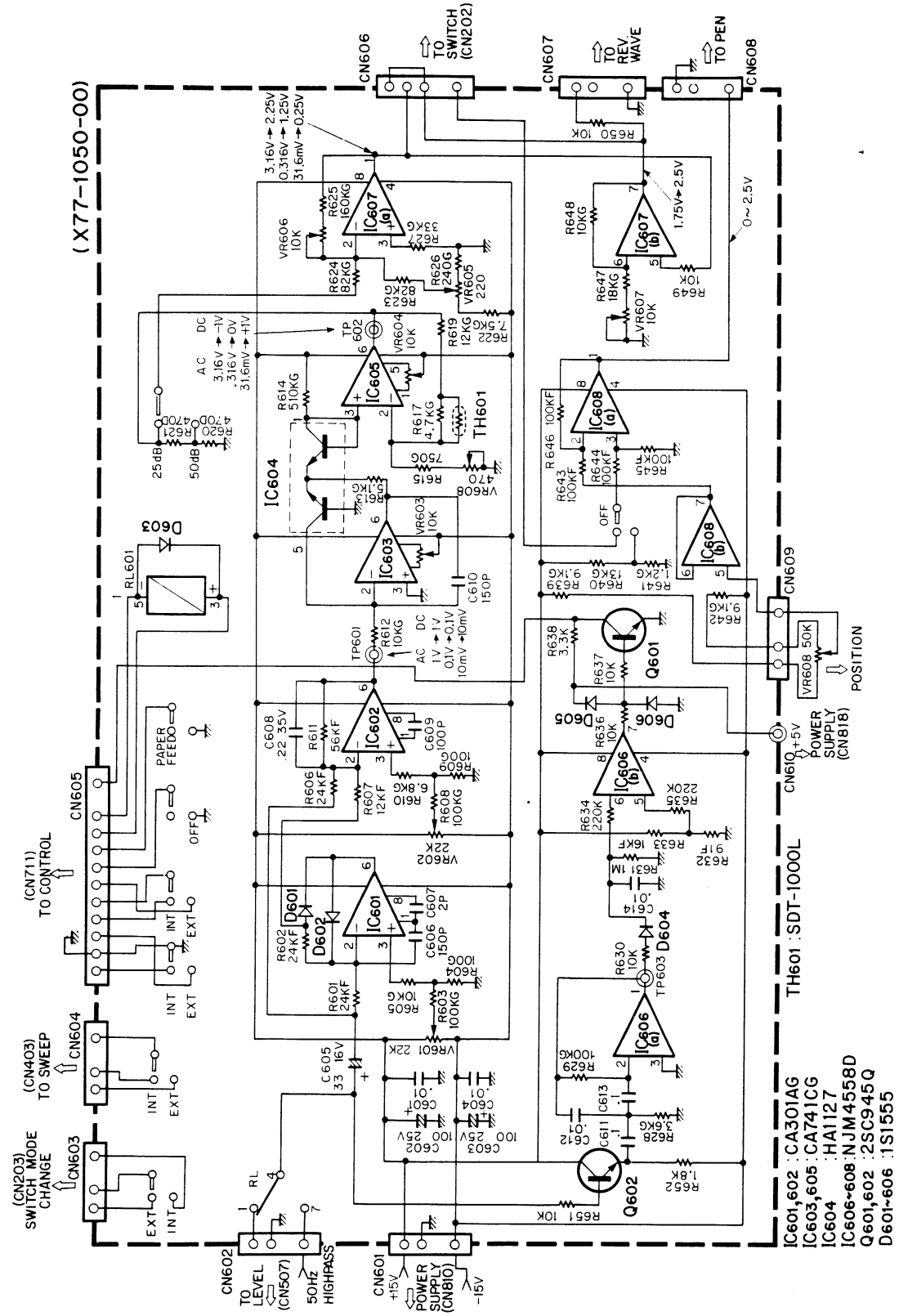
P.C. BOARD

LEVEL INDICATOR UNIT (X73-1250-00)



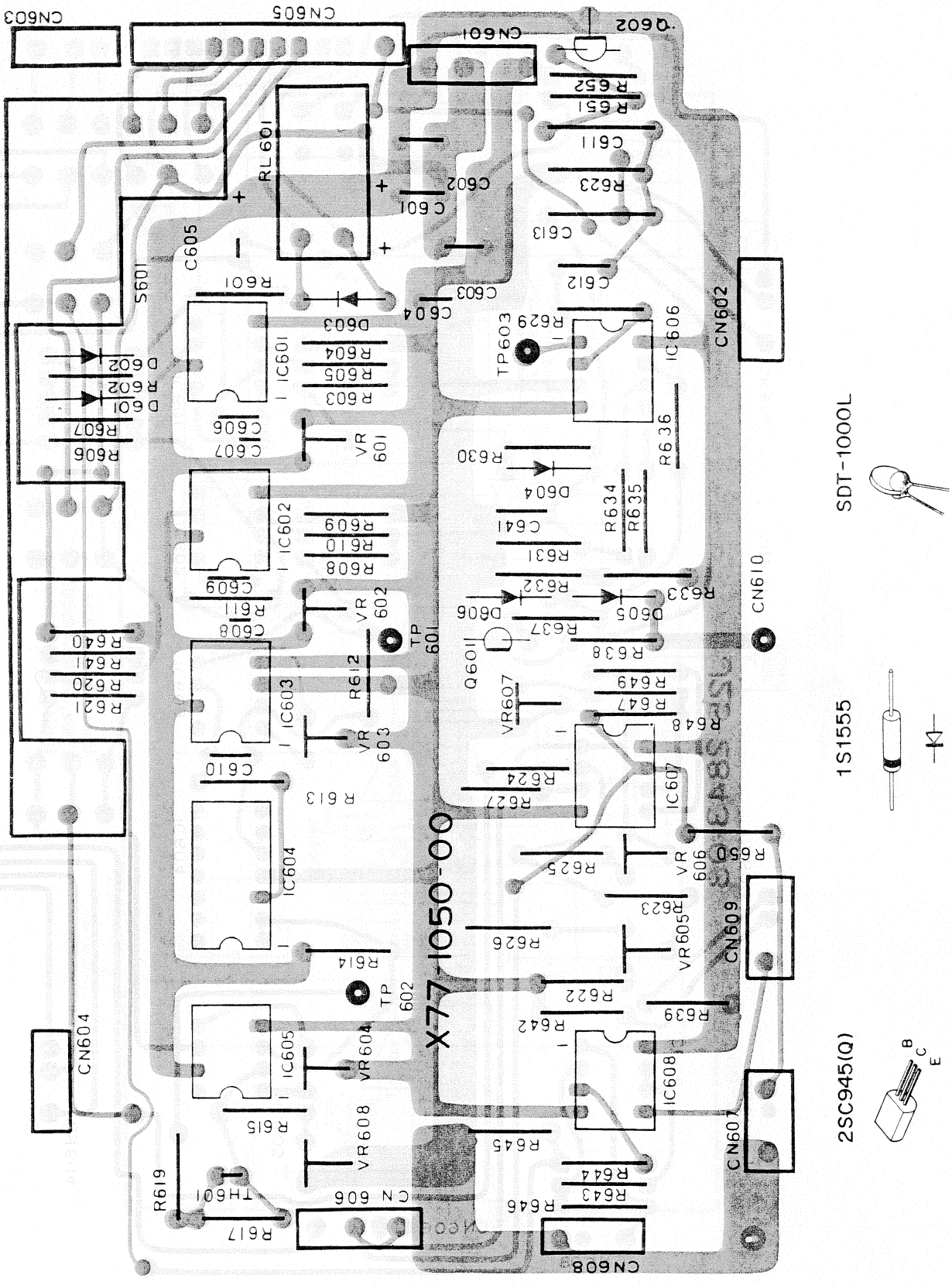
SCHEMATIC DIAGRAM

PEN RECORDER UNIT (X77-1050-00)



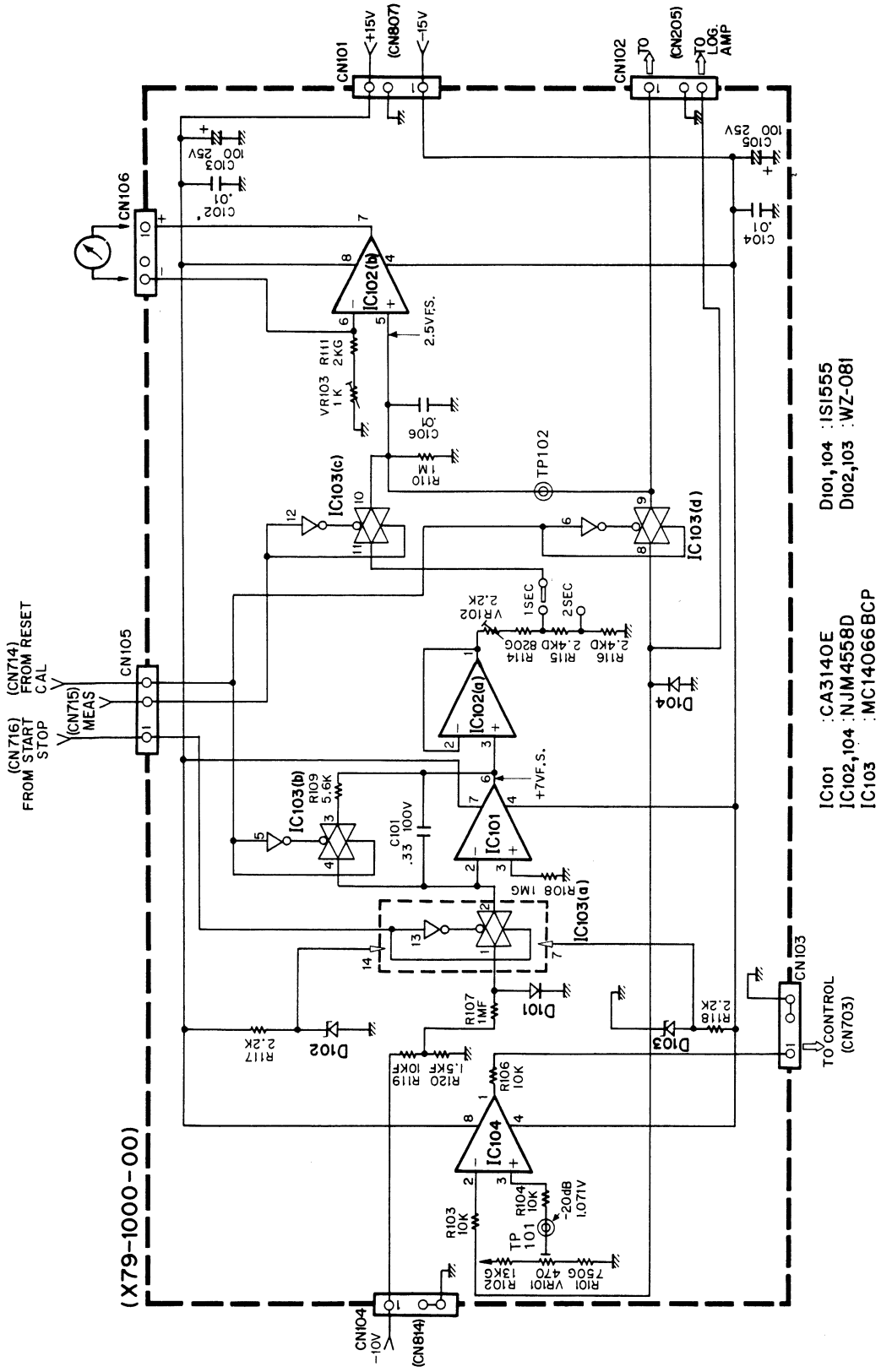
P.C. BOARD

PEN RECORDER UNIT (X77-1050-00)



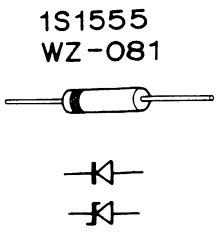
SCHEMATIC DIAGRAM

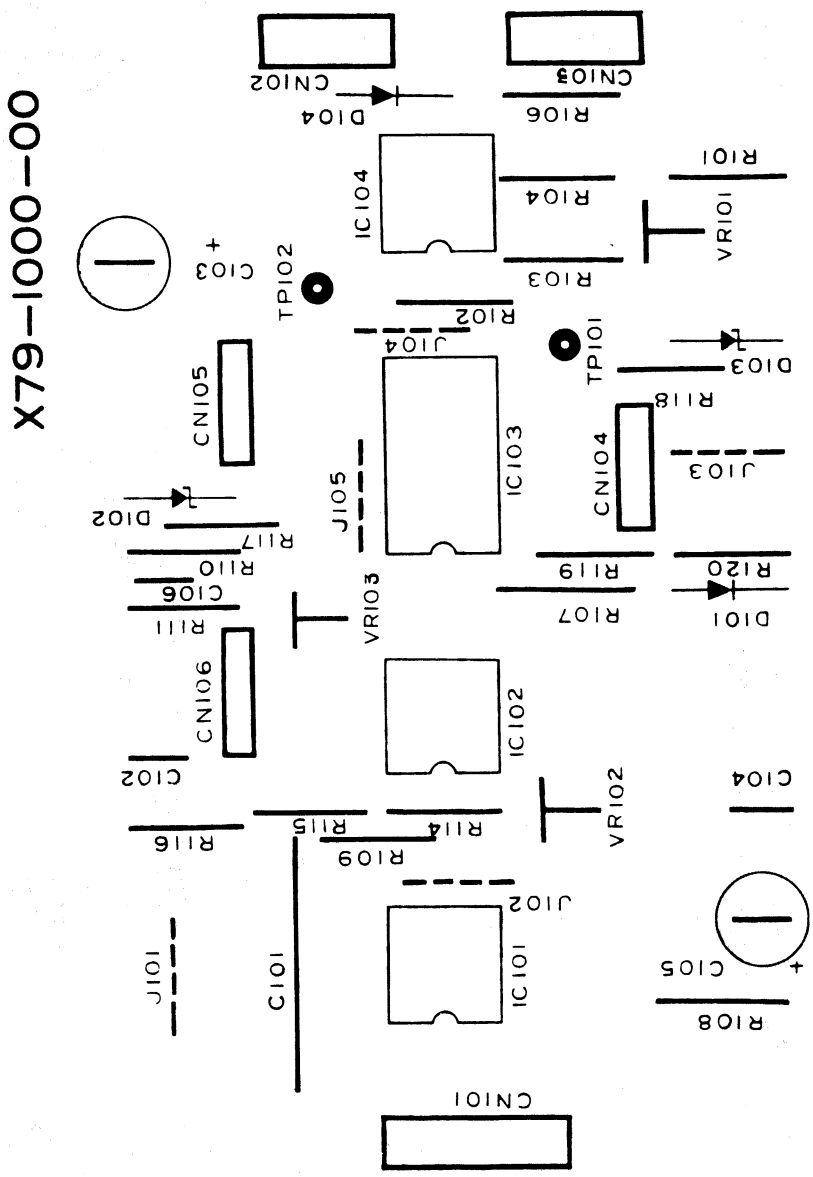
REVERBERATION INDICATOR UNIT (X79-1000-00)



P.C. BOARD

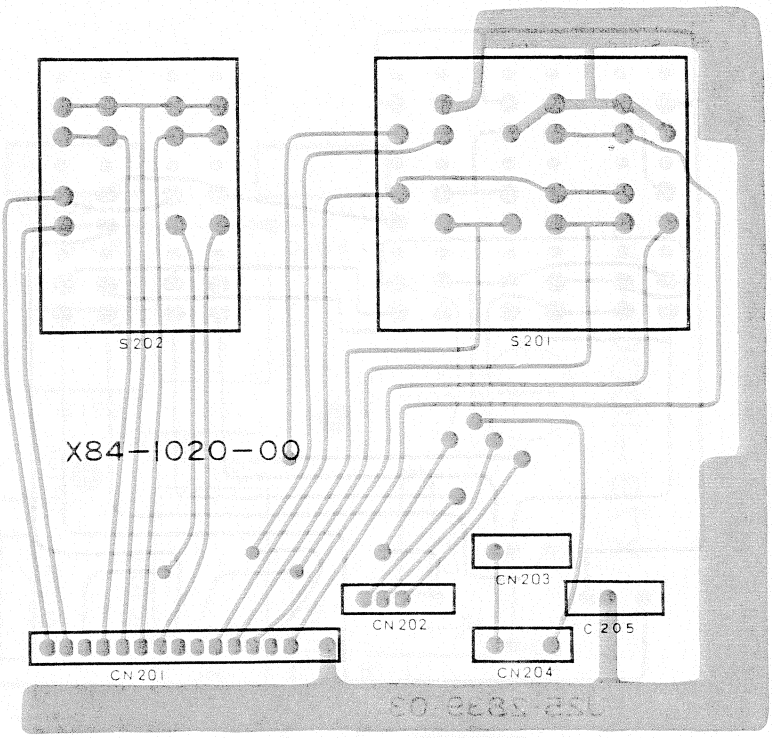
REVERBERATION INDICATOR UNIT (X79-1000-00)



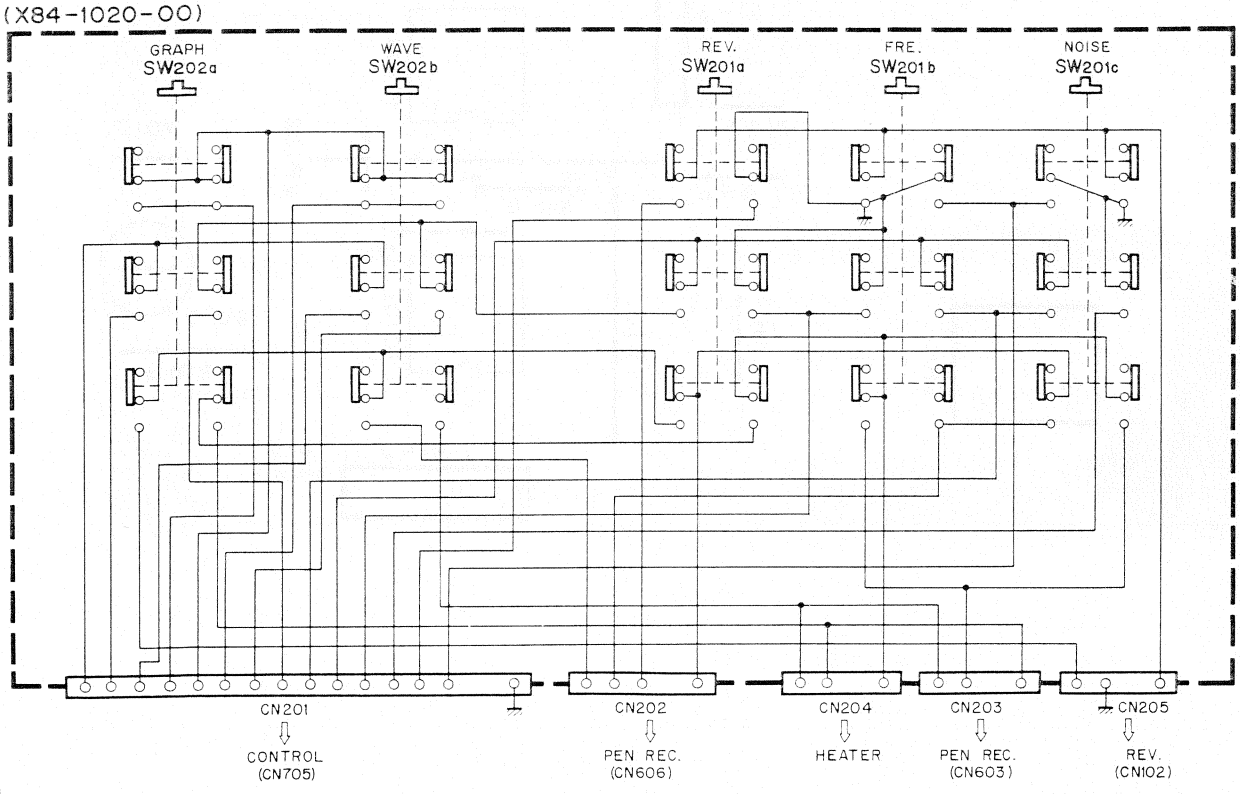


P.C. BOARD AND SCHEMATIC DIAGRAM

METER SELECTOR UNIT (X84-1020-00)

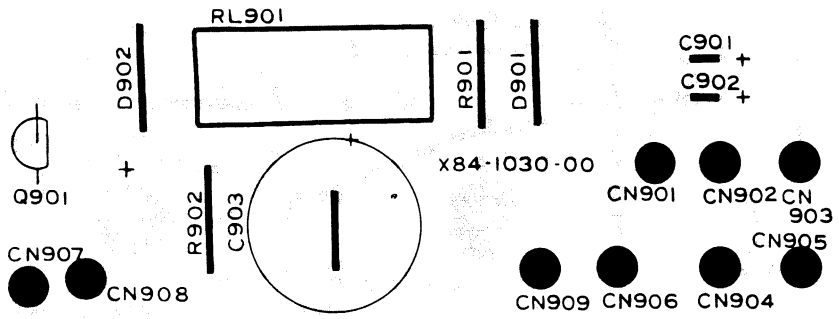


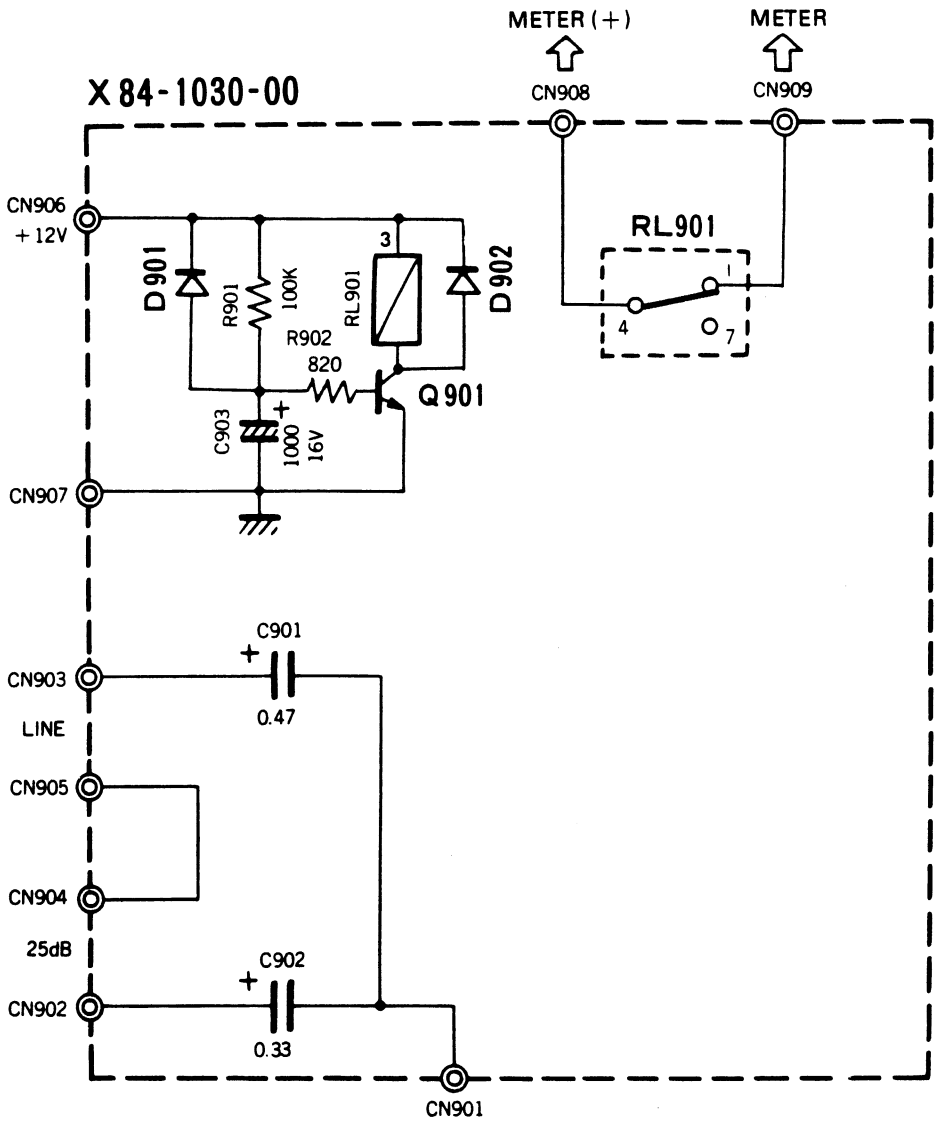
(X84-1020-00)



P.C. BOARD AND SCHEMATIC DIAGRAM

METER PROTECTION UNIT (X84-1030-00)

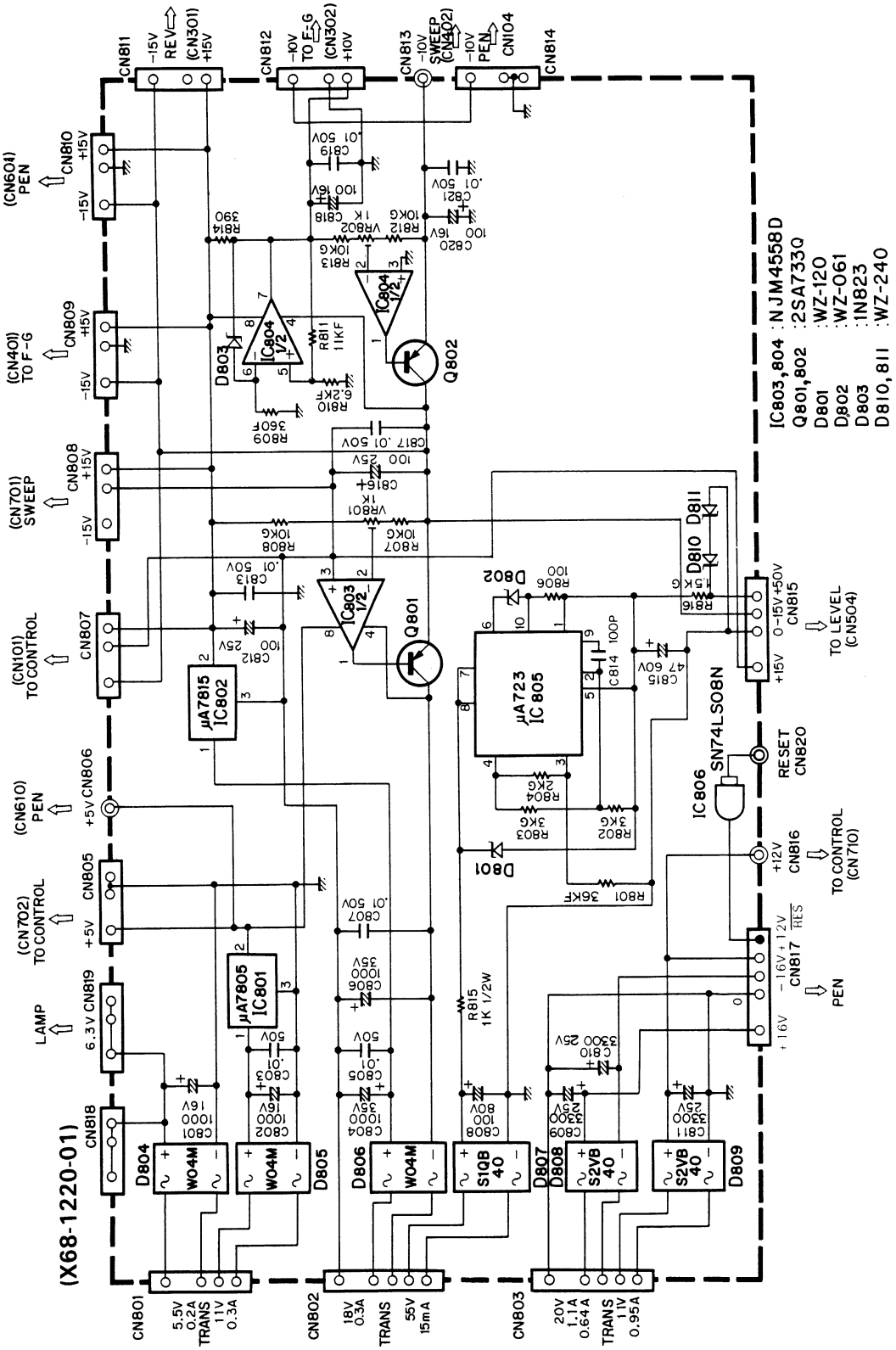




D901 D902	IS1555
Q901	2SC945Q
RL901	NRHD-12V

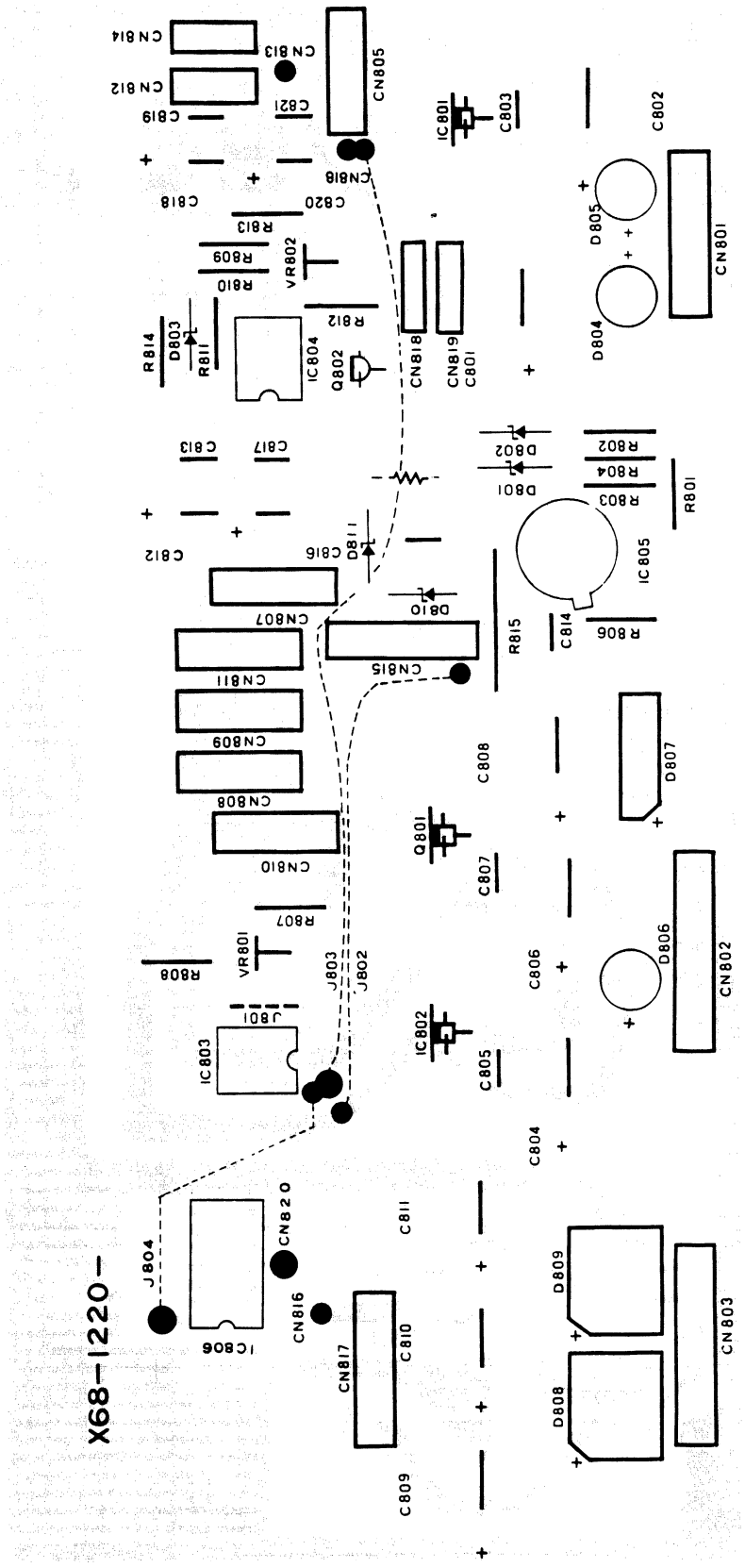
SCHEMATIC DIAGRAM

POWER SUPPLY UNIT (X68-1220-01)



P.C. BOARD

POWER SUPPLY UNIT (X68-1220-01)



WZ-061, WZ-120, WZ-197
1N823

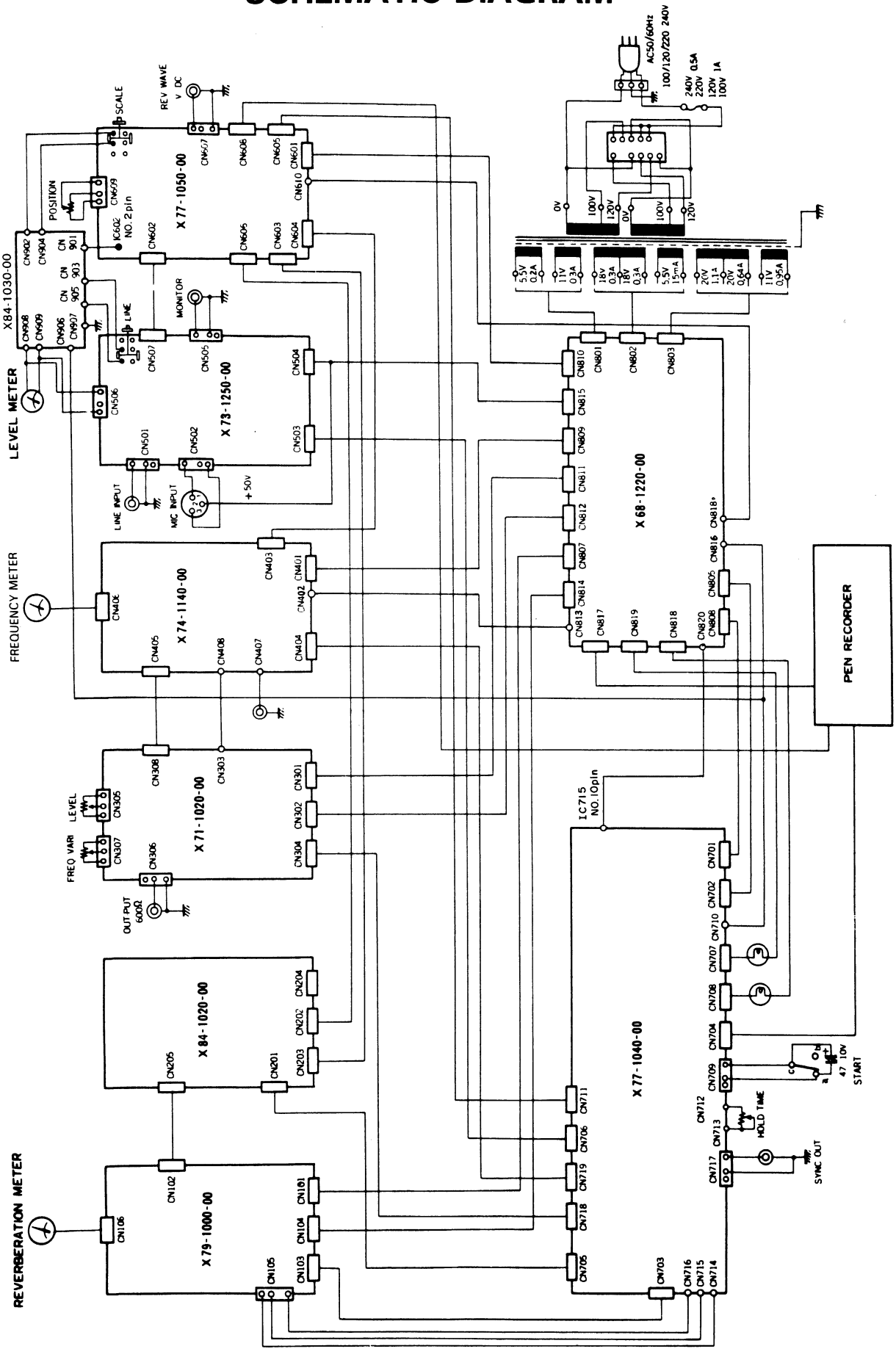
* Mounting of μA7805, μA7815 and 2SA755(C).
Apply heat sinker (grease) to the front and back of mylar.

2SA733(Q)

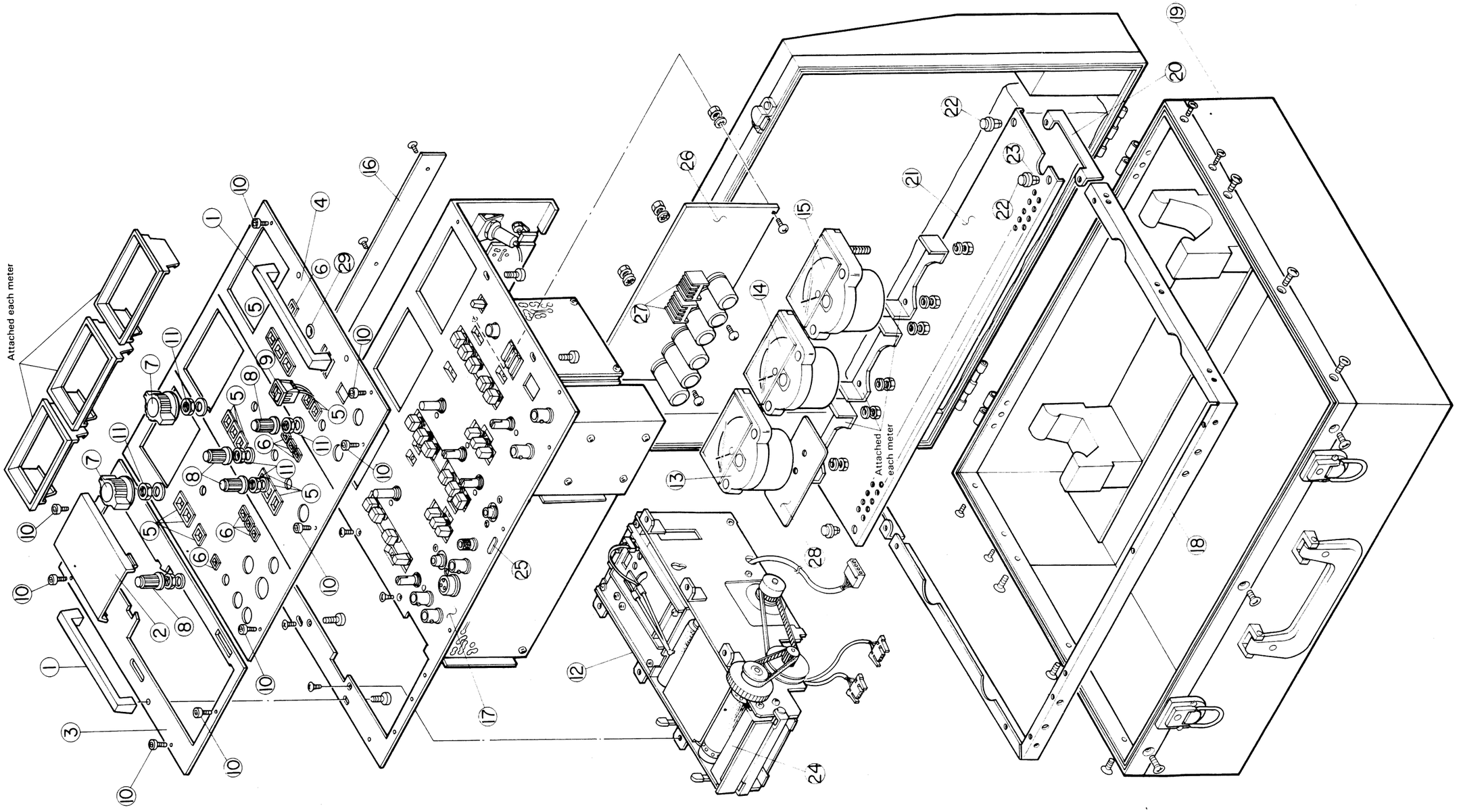
2SA755(C)

μA7805C
μA7815C

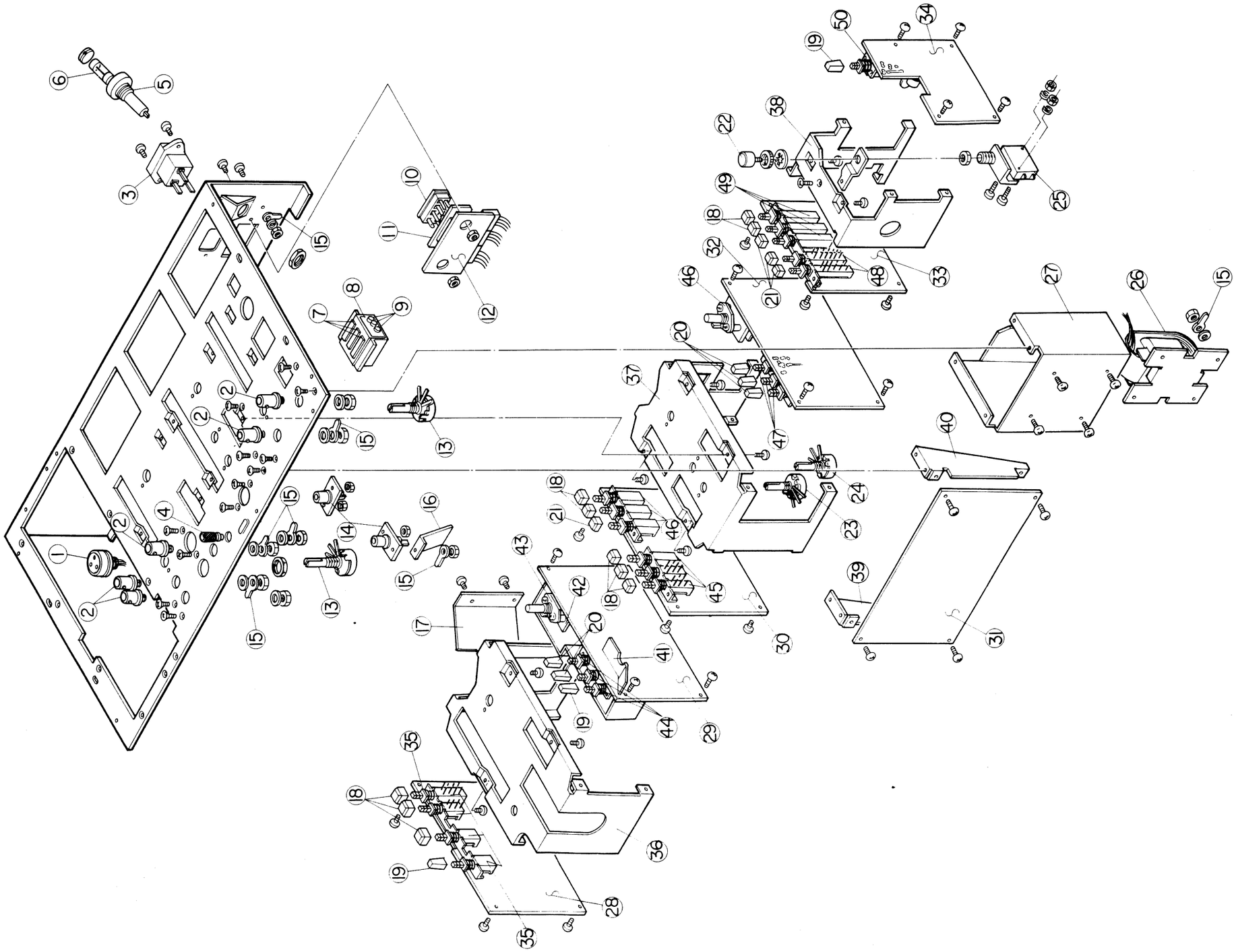
SCHEMATIC DIAGRAM



DISASSEMBLY (1)



DISASSEMBLY (2)



APPENDIX

PEN RECORDER (CD 3001-B)

This instrument is applied to recorders which are used in the recording parts of acoustic measuring system which measure sound sources.

PATINGS

Paper transfer speed: Determined by means of an external input power signal.

Input signal: Pulse input power (TTL, negative logic).

Paper transfer speed: 1200 PULSE/30 mm/sec

Hand-operated paper transfer: Paper can be transferred by means of a hand-operated dial (Reset: when ON, and power supply: when OFF)

Linearity: ±2.0% (vis-a-vis full-scale 50 mm).

Frequency response: 0~30 Hz, within ±10% (50 mm p-p amplitude)

Zero adjustment: More than ±25 mm

Input sensitivity: 0.5 V/cm, 0 V~2.5 V (center 1.25 V)

Power supply: ±16 V, 0.6 A
+12 V, 1A

Recording amplitude: ±25 mm (Limiter approx. ±27 mm)

Recording paper:

Length: 40 m, roll paper, with perforations

Printing: Special printing

Operating temperature and humidity for guaranteed specifications: −5° C~+45° C, 40~85%

Recording system: IC pen system (KT-106)

Remote:

IC pen: Turning the IC pen ON and OFF from outside is possible.

Motor: Turning the motor ON and OFF from outside is possible.

INPUT/OUTPUT POWER CABLE

COLOR CORD

CN 1

1 brown, (+16 V)
2 black (0 V)
3 orange (−16 V)
4 red (+12 V)
5 blue (Reset)

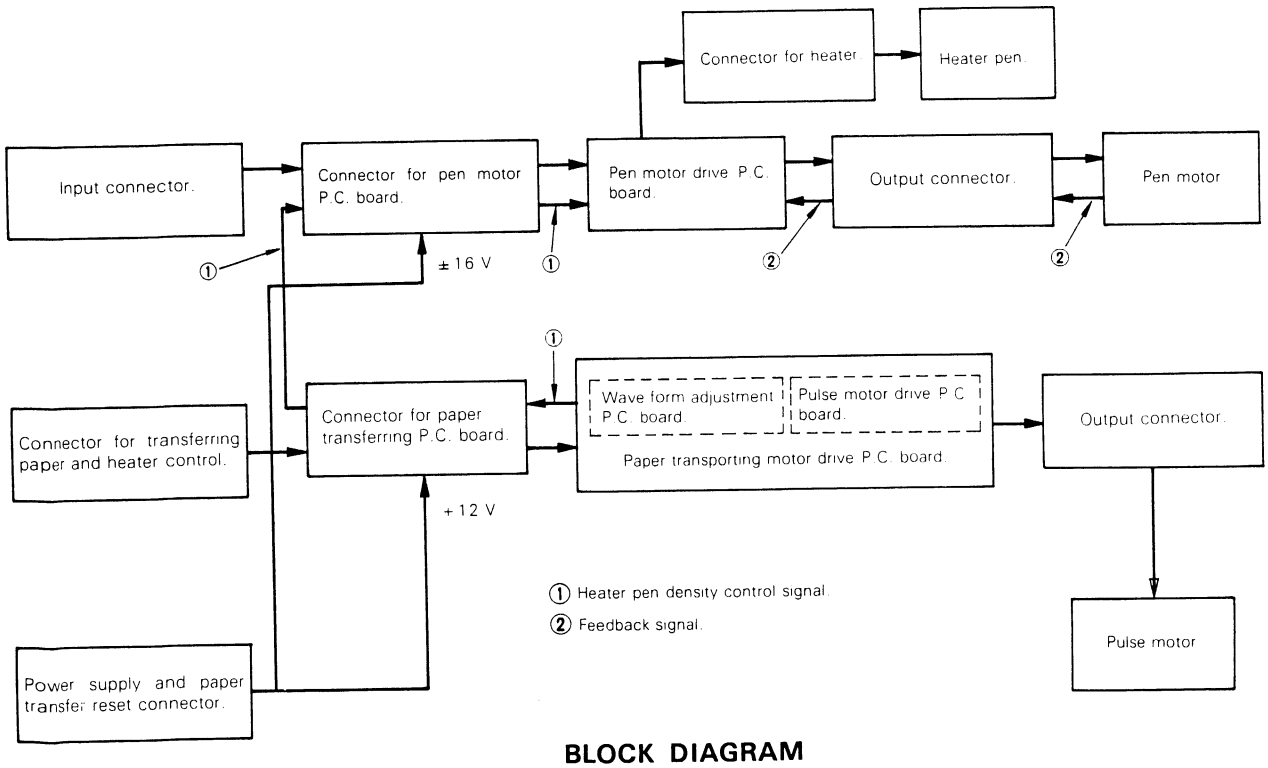
CN 2

1 yellow (signal +)
2
3 black (0 V)

CN 3

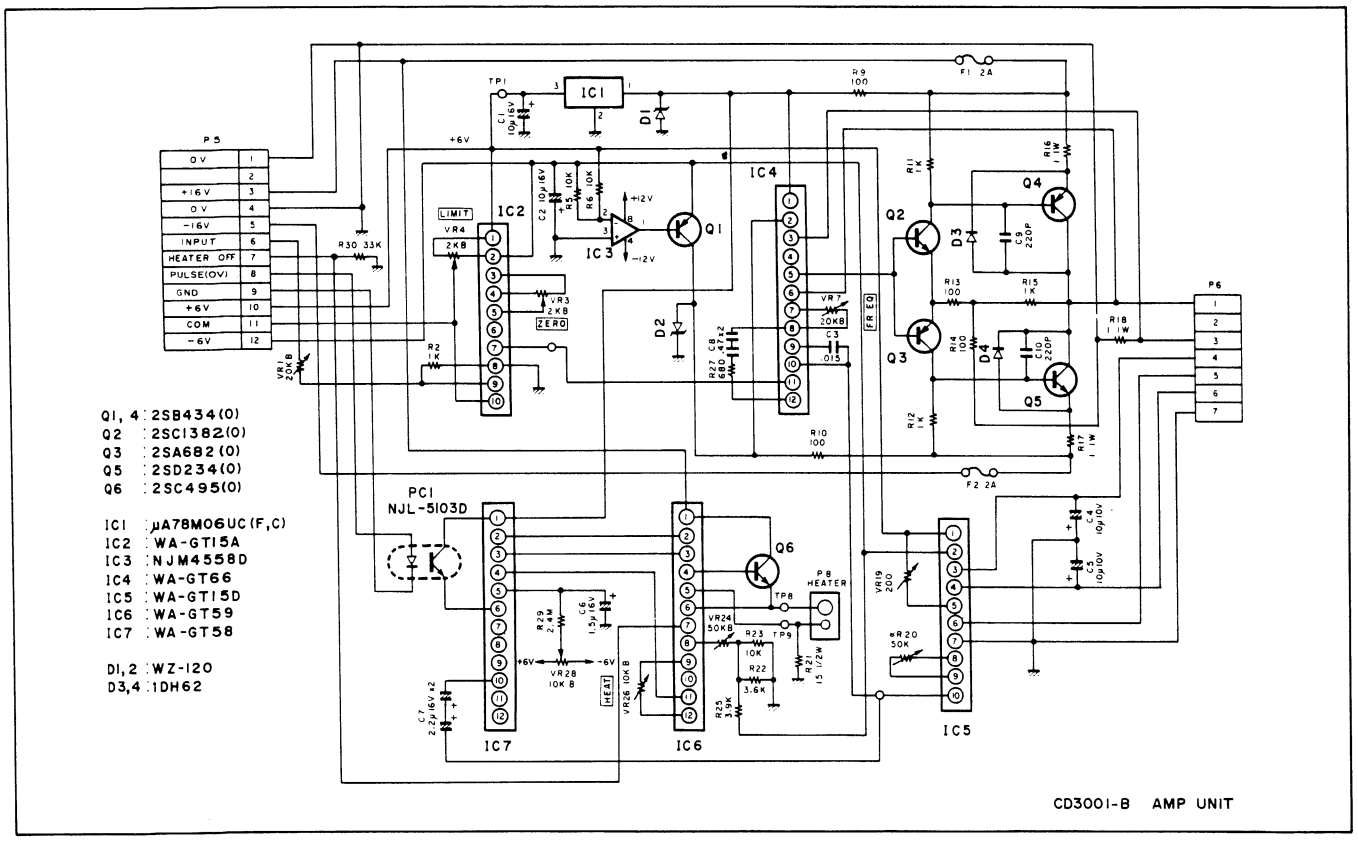
1 green (CLOCK)
2
3 white (HEATER)
4 2 and 4 are short circuit.

LENGTH The length from the body of the apparatus to the connector is: 250 mm± 10 mm

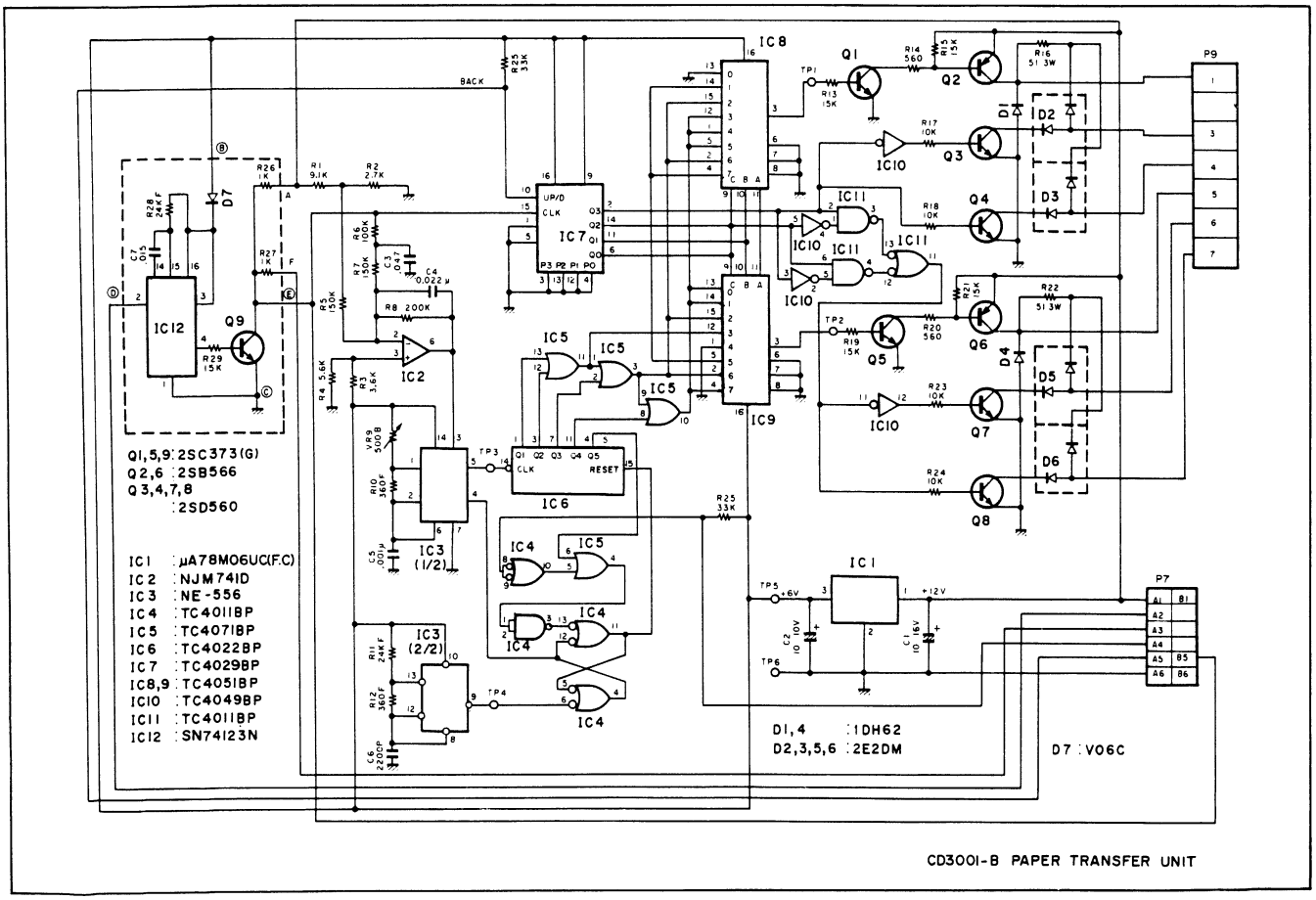


BLOCK DIAGRAM

APPENDIX



CD3001-B AMP UNIT



CD3001-B PAPER TRANSFER UNIT